THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW.

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THE ELECTRICAL RAILWAY.

DETAILS of the working of the Electrical Railway at Berlin are still wanting, though the announcement of the trial trip was made a short time ago. The success of the experiment can hardly be considered doubtful by any one; nevertheless, as the new line is really the first practical one on the new system, its working will be watched with great interest by all concerned in railway matters. Unlike the electric light, the progress of the new method of propulsion for railways will scarcely be watched with jealous eyes, as its success will not clash with any existing interests. Gas companies look upon the electric light as a formidable foe, and not without reason, though their interests are not likely to suffer to anything like the extent which has been predicted; but railway companies and railway engineers will only look upon the electrical railway system as a new source of enterprise to which to turn their attention.

The plant required by companies who light by gas, and those who light by electricity, is of quite a different nature, and it is not interchangeable in any way—that is to say, the plant of the gas company cannot be made to do service for electric lighting; no part of it can be utilised for the purpose.

Again, the capital required for starting an electric lighting system is small. In the case of railways the bulk of the capital is required for the track, which is common to every system of railway locomotion, whether the latter be effected by electrical or other means. Also, the actual cost of working by electricity is not likely to be less than that incurred in working by locomotives; indeed, we are not aware that it has ever been attempted to be proved that it is so. As a rival to existing interests, therefore, the progress of the electrical railway is not to be feared. Its use will not be to compete against existing systems, but rather to fill gaps hitherto left open.

For town work the electrical railway seems eminently fitted, as it possesses the advantage of freedom from noxious fumes, by no means an unimportant advantage, to which those who travel daily by the Underground Railway can testify.

Besides the electrical motors, those worked by compressed air are likely to have a fair share of attention, but the two are not likely to be rivals, as each will probably have its own sphere of usefulness. The compressed air system is an indirect method of obtaining motive power, and in such methods there is always a loss; but the air engine has the advantage of being independent in its action of the state of the track over which it runs, that is to say, mud and water will in no way hinder its action; for tramways, therefore, the compressed air system is admirably suited. For underground railways where the track is completely protected the electrical system would answer well, and it would have the advantage of rendering collisions impossible, whilst the transmission of the power being comparatively direct, the arrangement would be comparatively economical.

ELECTROMOTIVE FORCE OF THE VOLTAIC ARC.

By M. F. P. LE ROUX.

WHEN an electric current is established between two conductors of the same kind by the intervention of a gaseous medium, which is usually the vapour emitted by their substance, the inequality of the temperature of the portions of those conductors which are contiguous to this medium appears to be a general fact. It appears not less general that the extremity by which the positive electricity arrives possesses the highest temperature of the two.

The idea of attributing to this phenomenon a thermo-electric origin is old: it is mentioned in the treatise of Verdet. From the application of the principle of equivalence of heat to electrical phenomena, as explained in the works of Helmholtz, Clausius, and Sir William Thomson, in proportion to the heat disengaged at the point of junction of two heterogeneous substances, there corresponds an electromotive force acting in the reverse direction to the current. M. Edlund remarked, some time ago, that the hypothesis of the resistance of the voltaic arc, considered simply as a conductor, is not sufficient to account for the diminution in intensity which takes place in the current from the battery. Quite recently, M. Joubert (*Comptes Rendus*, July, 1880), in the course of his very interesting researches on magneto-electric machines, has arrived at the conclusion that the resistance of the arc was very small, that the difference of potential which exists between the two carbons was due, for the most part, to an electromotive force resulting from a phenomenon of polarisation of which he reserves the explanation.

I have before had occasion to refer to the experiment of M. Wartmann, who shows that, if the passage of the current is suspended for a small portion of a second, even one-tenth, one can, on re-establishing it, see the arc form itself afresh

without any contact of the carbons being necessary. This fact explains itself very well if it is considered that the carbon vapour, which I think constitutes principally the arc, can last for some time after the cessation of the current, and also that the hot gases which surround the carbons are conductors, as M. Edm. Becquerel has shown.

It being admitted that the passage of the current between the two carbons is due to a difference of potential, this difference should exist a certain time after the cessation of the current, and from the moment that it exists between the carbons still heated and conducting this difference should be manifested on a galvanometer placed in the circuit. I had some time ago endeavoured to show the existence of this difference of potential by means of a kind of double contact breaking wheel, analagous to the distributing wheel which I had employed to cause intermittent currents to pass between two places; but this kind of apparatus presented peculiar difficulties.

It appeared to me a better arrangement to employ a single contact only, worked by hand, to interrupt the current of the battery. With a galvanometer of high resistance a current could be observed over two-tenths of a second after the battery current was cut off, showing the existence of a *reverse* electromotive force. This effect can be produced with the carbons several millimetres apart; but the effects are much more marked when the arc is short at the moment of the cessation of the principal current. The experiment succeeds equally well whether the carbons are in the air or in a vacuum obtained by an ordinary air pump. Phenomena of the same kind can be produced with platinum instead of carbon electrodes. I believe that it is entirely a thermo-electric effect. The carbon would be positive by contact with its vapour in a degree increasing with the temperature.—*Revue Industrielle.*

SIMPLIFIED HOLTZ ELECTRICAL MACHINE.

By GEO. M. HOPKINS.

IN the domain of physical science there is nothing capable of being illustrated by more brilliant and pleasing experiments than frictional electricity; the means of studying it experimentally are in every one's hand, and if it were better known, doubtless many who are now comparatively uninformed on this subject would begin to make it a matter of study and experiment.

Many will recall the time in school days when the professor, with great exertion, trundled the ponderous frictional machine from behind the glass doors of the laboratory cabinet, and after no end of wipings, adjustments, and applications of amalgam, and after exerting an enormous amount of muscular force, succeeded in discovering that the atmospheric conditions were unfavourable to the generation of electricity, and the students, after being shocked by a quarter inch spark, were further shocked, and in another way, when informed that the philosophical machine must be reconsigned to its glass housings until a more propitious day.

Such was the general experience of the student of science a few years since, and such it is to-day in some of our educational institutions; but many of our schools—to their credit it may be said—have kept pace with the times and have provided modern apparatus capable of being used successfully under all conditions. The more recent forms of Holtz electrical machine are vastly better than the earlier ones, and the earlier ones were far superior to any of the forms of frictional machine. The makers of the improved Holtz machine in New York, Boston, and Philadelphia furnish them at reasonable prices, but there are numbers of our experimenters and students who would hardly feel warranted in purchasing one of them, who would construct one but for a few difficulties which at first sight seem almost insurmountable to the tyro. The questions that beset the inquirer are: (1) What kind of glass shall be used? (2) How shall the glass be apertured? (3) How shall the parts be adjusted and manipulated to secure the wonderful results attained by this machine?

It is the object of this article to fully answer these queries, and to give such details of construction as to enable any one having even a moderate mechanical ability to make, in a very simple manner, a machine fully as efficient as the best in market; and that, too, without any considerable outlay for materials. Without describing in detail the principle upon which the machine operates—these matters being fully treated in all works on physics—I will describe a machine which was made in odd moments as a matter of recreation, and which is as efficient as could be desired, yielding a spark fully six inches in length, equivalent to one half of the diameter of the rotating disc. This machine is shown in perspective in fig. 1, and in plan in fig. 2. Different forms of apertured disc are shown in (3) (4) and (5.) The glass for the discs is selected from common window glass. It should be as thin as possible, of uniform thickness, and flat. It is not essential that the glass be absolutely free from imperfections, although this is desirable. The rotating disc is twelve inches in diameter, the fixed disc is fourteen inches in diameter. I begin with the glass discs, as it is here that most of the difficulty in making the machine is supposed to lie; the especial trouble being in making the aperture in the revolving glass for receiving its hollow shaft, and in making the three large apertures in the fixed glass. I dispense with the hole in the revolving disc, and secure it to a vulcanite collar by means of a cement composed of pitch, gutta percha, and shellac equal parts, melted together. The method of applying the cement for this purpose is to warm the vulcanite collar, then cover it with a thin layer of the cement; then, after making the glass rather warm, lay it on a paper on which are described two concentric circles, one the size of the glass disc, the other the size of the collar, and while the glass is still hot press the collar down upon it. The vulcanite collar is screwed on the end of a wooden sleeve, C, (fig. 2), having at one end a shoulder to receive the collar and at the other end a small pulley to receive the driving belt. The sleeve, C, turns upon a piece of three-eighths inch brass tubing which extends through the vertical post, D, ten inches high and two inches in diameter. The end of the sleeve, C, next the glass disc, B, is countersunk to receive a screw, which enters the end of the brass tube holding the sleeve in place. This screw is covered by the glass when the revolving disc is in its place in the machine. The glass for the stationary or apertured plate, A, is first cut in circular form and then divided diametrically, and the apertures are formed by cutting half from each plate, a very simple matter as compared with cutting the three holes from an entire disc. The lateral holes are two and three-quarter inches long, and one and three-quarter inches wide at the larger end, and their sides are

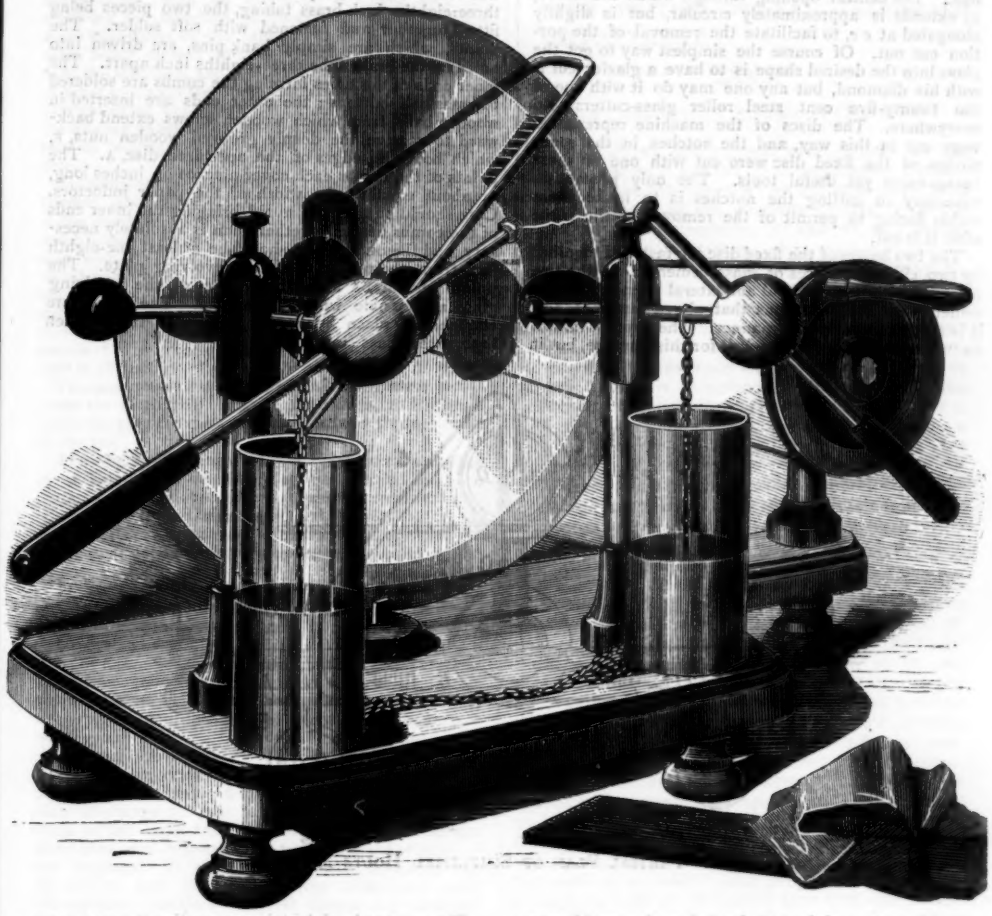
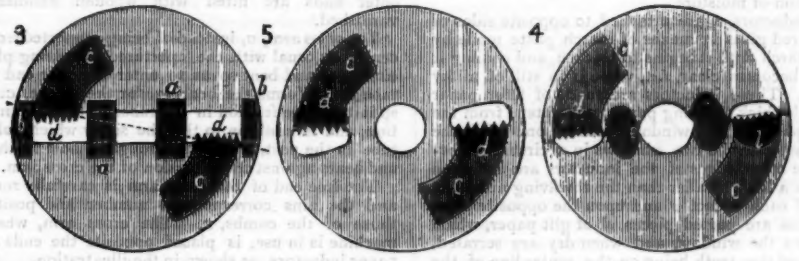


FIG. 1.



APERTURED DISCS.

nearly on radial lines extending from the centre of the disc. The central opening through which the sleeve, C, extends is approximately circular, but is slightly elongated at *e e*, to facilitate the removal of the portion cut out. Of course the simplest way to get the glass into the desired shape is to have a glazier cut it with his diamond, but any one may do it with one of the twenty-five cent steel roller glass-cutters sold everywhere. The discs of the machine represented were cut in this way, and the notches in the semicircles of the fixed disc were cut with one of these inexpensive yet useful tools. The only precaution necessary in cutting the notches is to make them rather flaring to permit of the removal of the piece after it is cut.

The two halves of the fixed disc are fastened together by two elliptical pieces of glass cemented to the two halves, between the central and lateral openings. The cement used is the same as that above described, and it is applied in a similar manner. The cement known as "stratena" answers very well for this purpose, but it must have several days to dry before the machine can be used.

The edges of the glass around the apertures and along the seams should be varnished with the best quality of alcoholic shellac varnish to prevent the accumulation of moisture.

Paper inductors, *c*, are attached to opposite sides of the apertured glass by means of starch paste made by cooking starch until it begins to thicken, and cooling it before it becomes clear, *i.e.*, while it is still of milky whiteness. These inductors are made of filter paper or of single thick drawing paper, and extend from the lateral openings or windows about one-third the distance between the two windows in a circular direction. The outer edges of the inductors are arranged on a circle a little smaller than the revolving disc. At the end of each inductor and upon the opposite sides of the glass are pasted pieces, *d*, of gilt paper, which project into the window, and when dry are serrated, the points of the teeth being on the centre line of the windows.

In front of the revolving plate, B, two combs or collectors, E, are supported upon glass columns having wooden bases and tops. These combs are made of three-eighths inch brass tubing, the two pieces being fitted together and fastened with soft solder. The points, which are simply bank pins, are driven into holes in the brass tube three-eighths inch apart. The inner ends of the tubes forming the combs are soldered to brass ball buttons; the outer ends are inserted in wooden balls, from which wooden screws extend backward to receive the deeply grooved wooden nuts, F, which hold the edges of the apertured disc, A. The points of the combs each cover a space 2½ inches long, or about equal to the width of the paper inductors. Care should be taken to avoid bringing the inner ends of the combs nearer together than is absolutely necessary, and the outer point should be at least one-eighth inch from the periphery of the revolving plate. The points should be as near the face of the revolving glass as possible without touching. The combs are clamped in place by wooden screws in the wooden tops of the glass standards.

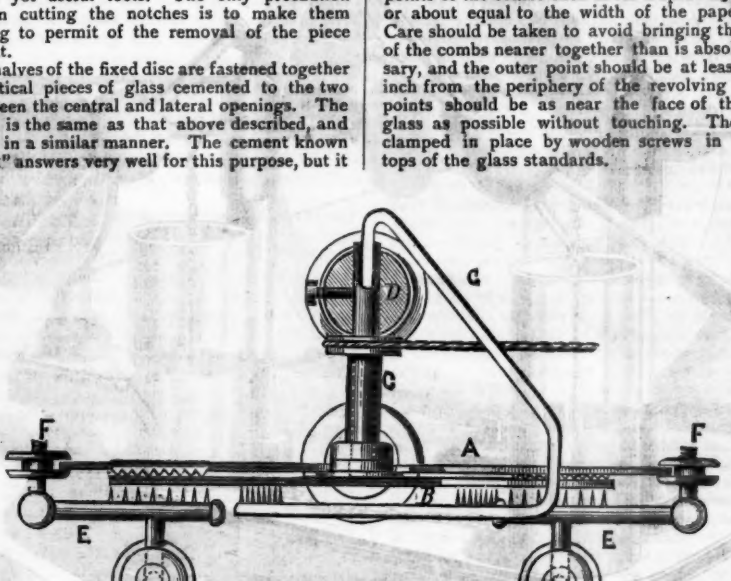


FIG. 2.—PARTIAL PLAN OF SIMPLIFIED HOLTZ MACHINE.

The outer ends of the tubes supporting the combs are fitted to tubes soldered in the large hollow balls. Through these balls the discharging rods slide with a gentle friction. The inner ends of the discharging rods are provided with spherical knobs, and their outer ends are fitted with wooden handles well varnished.

The cross arm, G, instead of being supported from the centre, as usual with the apertured revolving plate, is elongated and bent so as to enter the rear end of the tube which forms the bearing for the sleeve, C. It is split to create friction in the tubes to retain it in position, and in addition to this the screw which holds the tube in the post, D, passes through a hole in the tube and bears against the extension of the cross arm.

The free end of the cross arm is carefully rounded, and the pins correspond in number and position to those of the combs, E. The cross arm, when the machine is in use, is placed opposite the ends of the paper inductors, as shown in the illustration.

The lower edge of the apertured plate, A, rests in an adjustable support on the table.

The base of the machine is 13 inches wide by 14 inches long, with an extension 9 inches long for receiving the standard of the driving pulley, which is made adjustable on the table to tighten the belt, the table being slotted to receive the screw projecting from the standard, and the foot of the table answering as a nut to clamp the standard in any desired position. The pulley on the sleeve is 1½ inch in diameter, and the driving pulley is 6 inches in diameter. Almost any kind of belting will answer, but a gut string is preferable.

To complete the machine two condensers or small Leyden jars are required. These may vary in size; in the machine shown they are 2½ inches in diameter and 6 inches high, and are covered on the inner and outer side with tin foil to within 3 inches of the top, the starch paste before mentioned being used to fasten the foil. The uncovered portion of the jar is varnished with shellac. If jars of the desired form and proportion are not attainable, bottles may be readily cut by means of a hot curved rod of iron about one quarter inch in diameter.

The condensers are placed outside the glass columns under the tubes that support the combs, and a small chain hanging on each tube touches the tin foil lining of the jar.

The outer coatings of the jars are connected by a small brass chain lying on the table. The plate, A, should be placed about three-sixteenths of an inch from the plate, B, and it must be turned so that the edge of the windows to which the gilt paper is attached is exactly opposite the teeth of the combs, E.

To charge the machine the ends of the discharge rods are brought into actual contact, and a piece of vulcanite, a quarter of an inch thick, 4 inches wide, and 10 or 12 inches long, is rubbed with a catskin, a piece of flannel, or a piece of silk, and applied to one of the paper inductors. At the same moment the machine is turned toward the gilt paper points. A strong smell of ozone and an increased resistance to turning are the first indications of the successful charging of the machine. Now by slowly separating the discharge rods the spark will pass over an increased distance until it is fully 6 inches long. To produce the silent discharge all that is required is to remove the chain on the table from one of the jars. No special directions are required as to the management of the machine. A dry atmosphere is favourable to its action, and it must be kept free from dust. Air currents interfere with its operation; therefore it should be used in a room with the doors and windows shut.

I have so far described only one form of apertured plate. In (3) is shown a form in which the disc has a central portion, 1½ inches wide, removed and the two parts are connected by glass strips, *a a* and *b b*, cemented in the manner already described. When this form of plate is used the combs must be inclined to correspond to the direction of the edges to which the gilt paper is attached. (5) shows the usual form of plate, which requires the aid of the glass cutter, as the holes cannot be readily made by one unused to operations of this kind.—*Scientific American.*

PREPARATIONS are being made at Penzance for the landing of the shore end of the new independent cable between the Cornish coast and America.

TELEGRAPHIC APPARATUS IN USE IN THE BRITISH POSTAL TELEGRAPH DEPARTMENT.

XXXII.

THE QUADRUPLEX SYSTEM.—(*Continued.*)

FIG. 130 shows the general arrangement of the apparatus at each station on a quadruplex circuit: R^1 and R^2 are the relays which are used to respond to the changes in the currents produced by the action of the transmitters, T^1 and T^2, at the corresponding distant station.

R^1 is a Post-Office standard relay (Article V., March 15th, 1880) which responds to the working of the double current transmitter at the distant station. This relay acts independently of the strength of the current, that is to say, it responds to reversals whether they be weak or strong, and it is therefore not influenced by the action of the transmitter, T^2, at the distant station. R^2 is a "compound" polarised relay, shown in general view by fig. 131, which responds only to an increase in the strength of the currents, whatever their direction, and responds therefore to the action of the transmitter, T^2, at the distant station. The principle of its action is shown by fig. 132.

The tongue, *r*, is placed directly in the centre of the field of the electro-magnet operating it. It is so adjusted by means of the springs, *n* and n^1, that it is not affected by the weak reverse currents sent by the transmitter, T^1. The screw stops, p^3 and p^4, regulate the play of the tongue; p^4 limiting the movement of the lever, N, in one direction, while p^3 limits the movement of *r* in the other direction. When *r* is in its normal position it is in contact with lever, N, whilst N is in contact with p^5; the local circuit of *e* through the non-polarised relay, S, is thus completed, and the armature of the latter is drawn down. But when *r* is moved by a current in either direction, so as either to break itself away from N, or to break N away from p^2, then this circuit is broken, the armature of S rises, and completes the local circuit of S^2, the reading sounder. The proper tensions of the springs, *n* and n^1, of course vary with the condition of the line, and they are kept so adjusted that while *r* responds to every current sent by T^2, it is not affected by those sent by T^1. It will be noticed that whenever the line current is reversed, and the tongue, *r*, is moved from one side to the other, a momentary short circuit through *e* is formed; but this change of position is facilitated by the large condenser, C, and the movement of the tongue is so rapid that the electro-magnet of the "uprighting sounder," or relay S, has not time to become magnetised, so that the period of the short circuit is not felt. If a simple neutral relay were used it would act independently of the direction of the current, but it would fall back, and be again attracted when currents were reversed, thus causing a break or click in the local circuit. This is not the case, however, with Mr. Gerritt Smith's relay.

Fig. 133 shows the different parts of the contacts of the relay. The contact, p^2, is permanently fixed and cannot be altered; p^4 and p^3 are adjustable and are ivory tipped.

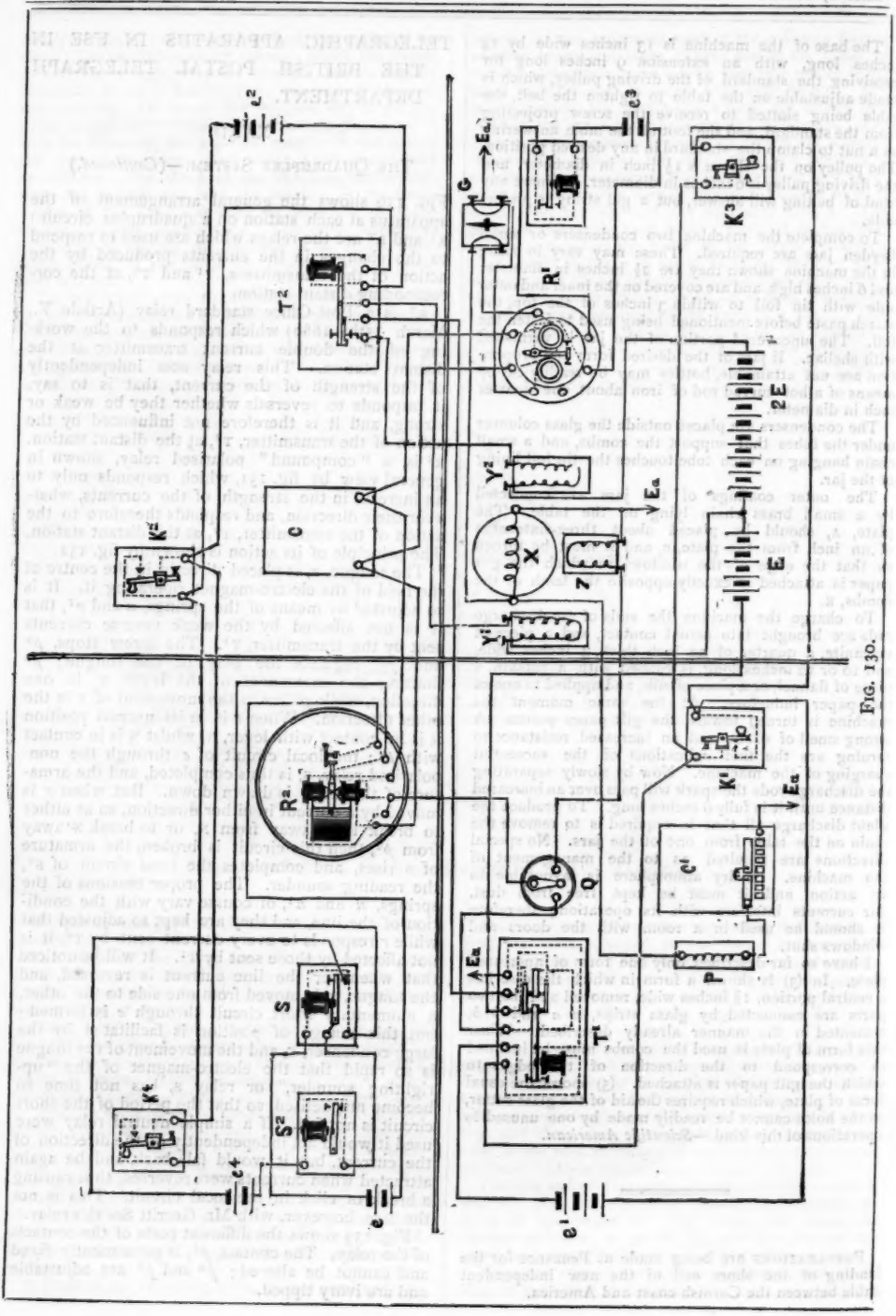

e2
e3
Ea1
G
K3
R'
T2
2E
E
Y2
Ea
X
Z
Y1
K2
C
R2
K1
Ea
C'
Q
P
AEa
T1
S
S2
K4
e4
e
e1

FIG. 130.

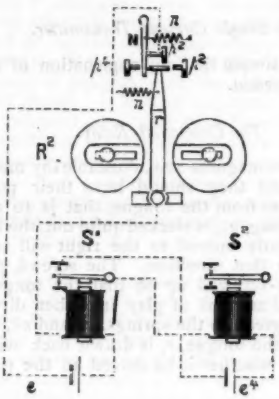


FIG. 132.

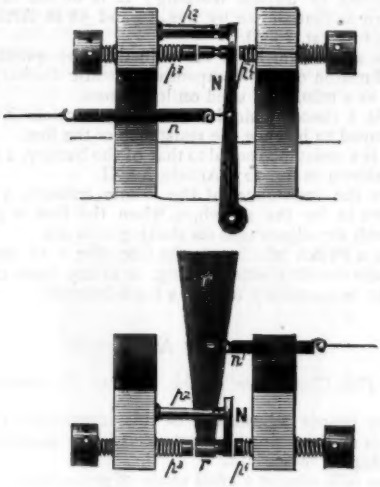


FIG. 133.

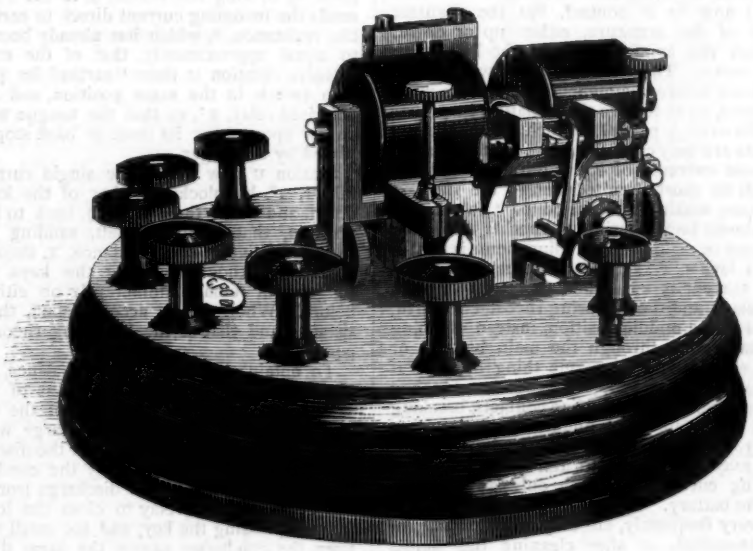


FIG. 131.

FIG. 130.

C¹, in fig. 130, is a condenser which is used for compensating the static charge on line as usually employed in duplex working; it is of the same pattern as that shown by figs. 56 and 58 in Article XII. (July 1st, 1880).

P is a rheostat used for adjusting the quantity and duration of this compensating static discharge. It is, as a rule, only used on long lines.

X is a rheostat, similar to fig. 55, Article XII., employed to balance the resistance of the line.

Y¹ is a resistance equal to that of the battery, 2 E,* also shown in fig. 127, Article XXXI.

Z is the resistance of the whole battery, 3 E, thrown in by the switch, Q, when the line is put to earth for adjustment on starting to work.

Q is a switch which puts the line direct to earth for adjustment at first starting, or at any time that it may be necessary to take a fresh balance.

ADJUSTMENT OF APPARATUS.

The Pole Changer or Double Current Transmitter.

The proper adjustment of this transmitter (fig. 128) is of the utmost importance to the successful working of the circuit.

The following is a good mode of procedure.

Screw down the upper limiting stop at the electro-magnetic end until the play is reduced to about $\frac{1}{64}$ of an inch, or about half its working play.

Now turn to the contacts, and gradually raise or lower the upper screw, d, until the lever, s_1, whose position it adjusts, just touches the lower point on the lever end, t, and that of the screw itself, then carefully withdraw or raise the lower screw, d_2, until the other lever, s_2, does the same. All four points will now be in contact, but the slightest movement of the armature, either up or down, would break this contact, and put the battery to line and earth. The limiting stop which was screwed down before commencing operations must now be raised, so as to give the armature its proper play, a trifle over $\frac{1}{32}$ part of an inch. When these adjustments are very carefully made, the transmitter will send out currents of equal duration, and the battery will be short-circuited during the shortest possible time, making the period of "no current to line" almost imperceptible. Another reason for so much care in making these adjustments is this:—If the two levers, s_1, s_2, are too much apart, the incoming current is compelled to return through the two relays and the balancing rheostat to earth, when T² is in the middle position, instead of going by the nearer way through the main battery, or resistance equal to it. The same thing happens if the springs are adjusted too close together, for they are then rocking between the line contacts, breaking the circuit of the line, and unduly short-circuiting the battery. By ordinary care the period of short-circuiting may be reduced to almost nothing, and the arriving current will then only go to earth through the battery. It should not be necessary to re-adjust very frequently, but only when putting on a new transmitter, or after cleaning the points when they have become dirty.

If the circuit is working well it is advisable to let it alone, and never make alterations at random. If a fault appears, make sure that it is not on the line, and take a balance before altering anything. Nothing will overcome an intermittent earth or contact with any system, but a steady partial earth may always be got over by a re-adjustment of the balance.

The Single Current Transmitter.

This is so simple that no explanation of its adjustment is needed.

The Compound Relay.

The electro-magnets are adjustable by means of checknuts, and they should have their poles at equal distances from the tongue, that is to say, so that if the spring, n_1, is slacked quite out, the tongue on being slightly moved to the right will tend to move over in that direction. The screws, p^3 and p^4, should be screwed up so that the tongue will have an equal amount of play in either direction. The tension given to the springs, n^1 and n^2, should be such that the tongue, r, is drawn back with the same "pull," whether it be moved to the right or left.

Balancing on commencing to work.

Let U be the up station and D the down station.

As soon as the line is connected, station U exchanges signals with D before balancing. If the signals come reversed, the direction of the current through the standard relay, R¹, must be reversed. Station U now instructs D to put to earth; D complies by turning the switch, Q, to the right, which sends the incoming current direct to earth through the resistance, Z, which has already been adjusted to equal, approximately, that of the entire main battery. Station U then "earths" by placing his own switch in the same position, and adjusts his polarised relay, R¹, so that the tongue will remain at rest upon either its front or back stop, when so placed by the finger.

Station U now closes the single current transmitter, T², by blocking either of the keys, K², K⁴, down, and turns the switch, Q, back to its original position, that is, to the left, sending the entire battery to line. The resistance, X, should now be adjusted, without touching the keys, until the tongue will remain indifferently on either stop as before. When this is accomplished, the line resistance and that of the balancing rheostat will be equal.

To obtain the electro-static balance, station U transmits dots or dashes by means of T¹, at the same time altering the capacity of the condenser, C¹, until it neutralises the discharge which takes place after each signal. When the discharge cannot be entirely neutralised by the condenser, that is, when a little too much discharge from the condenser causes the relay to close the local circuit upon depressing the key, and too small a discharge from the condenser causes the same defect upon opening the key, it is better to leave the excess in, and tone it down or retard it by means of the rheostat, P. The balance of this relay insures that of R² without further precaution.

* It is found that the large battery need not be greater than 2 E.

Finally, station U again turns switch, Q, to the right, putting the line to earth through resistance equal to his entire battery; and station D proceeds to obtain a balance in the same way, having accomplished which he apprises U.

Station U then requests D to send V's from T^1, leaving T^2 open and at rest: the signals are received at U on relay R^1, and at the same time the springs, n and n^1, of the compound relay, R^2, should be pulled up sufficiently to hold the tongue at rest in the central position with the uprighting sounder circuit closed. D is then requested to leave T^1 at rest, and send A, B, C's on T^2. These signals should be received at U upon the compound relay, R^2, only. D is then requested to hold T^1 down, and continue to send on T^2. These signals should also be received upon R^2, but in the opposite direction, and R^1 should at the same time close its own local circuit. D should now send V's on one side, and A, B, C's on the other; and if they come without breaking, the pole changer at D is properly adjusted; but if there is any tendency to break up or kick on the R^2 side (called the B side), it may be assumed that the battery is either too weak or is short-circuited too long at the opposite end.

The contact points of the uprighting sounder or non-polarised relay should be adjusted as close as those of an ordinary relay. Its local battery should also be frequently attended to, as it is very hard worked.

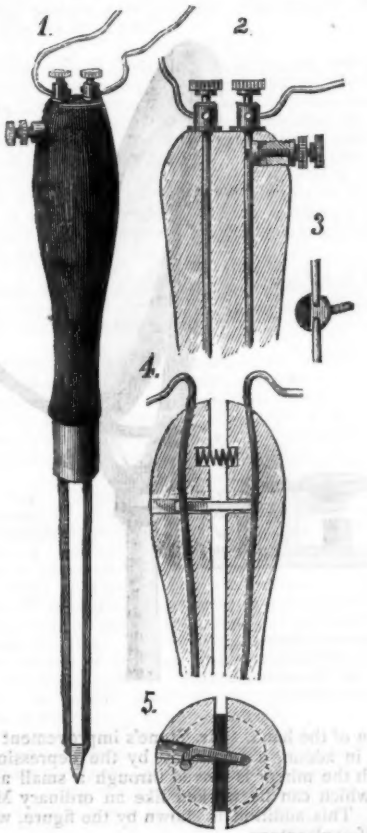
It is a good plan to disconnect the B side locals when closing the circuit for the day.

With a little practice the whole of these adjustments may be done in five minutes or even less, for it is not always necessary to alter even the springs of the compound relay.

SOLDERING BY ELECTRICITY.

THE engraving shows a soldering iron heated by the electric current, and capable of melting all kinds of solders, such as gold and silver solder, which have heretofore required a blowpipe to melt them. It may also be used for the more fusible solders employed in making tin ware. Now that the electric current is distributed so generally and is used for all manner of purposes, it seems quite practicable to employ it for soldering.

Figs. 1, 2, and 3 show one form of electric soldering iron, fig. 1 being a perspective view, fig. 2 a section showing the switch for controlling the current, and fig. 3 a detail view of the switch button. Figs. 4 and 5 are views of a modified form of the device. In figs. 1 and 2 the electric conductors extend through and project beyond the handle, and embrace a piece of platinum or other material offering sufficient resistance to the passage of the electric current to become heated more or less according to the strength of the current. One of the conductors is separated near the upper end of the handle, and bridged by a button made partly of electrical conducting material and partly of insulating material, so that by turning the button the circuit may be completed or broken as circumstances may require. The device shown in figs. 4 and 5 is on the same general principle, the only difference being that the handle is split lengthwise, and the two portions are pressed apart by a spring. When apart to their fullest extent a hook attached to one of the conductors touches the other conductor and short-circuits the current in the handle. When the two halves of the handle are pressed together the current passes through the refractory point.



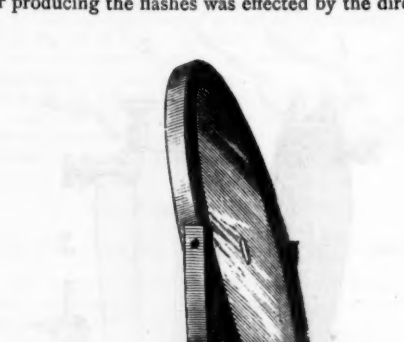
When the point is heated to incandescence the tool may be used for melting either silver or gold solder. For melting soft solder the heat may be less intense.

This invention was recently patented by Mr. C. E. Ball, of Philadelphia, Pa.—*Scientific American.*

ON the 25th ult. the western gable of the new Board School in Orange Street, Southwark, was struck by lightning and hurled to the ground. Fortunately no one was in the building at the time.

STONE'S IMPROVED HELIOGRAPH.

A VERY simple addition has recently been made to Major Macgregor's Ekowe Pocket Heliograph (TELEGRAPHIC JOURNAL, October 15th, 1880) by Mr. W. Stone, the constructor of the instrument. In the original apparatus the movement of the mirror for producing the flashes was effected by the direct



action of the hand. Mr. Stone's improvement consists in adding a small key, by the depression of which the mirror is moved through a small angle, and which can be worked like an ordinary Morse key. This addition is shown by the figure, which is self-explanatory.

CANADIAN TELEGRAPHY.—The Montreal Telegraph Company was organised in 1847 with a capital of £15,000. It had 500 miles of poles and wires and nine offices. It has now a capital of £500,000, 12,700 miles of poles, 21,500 miles of wire, and 1,674 offices. The number of telegrams sent over the line in 1880 was over 2,000,000; and its earnings for the year were £137,000. Within the same period Montreal has increased from 50,000 to 150,000, and now that a contract for the railway to British Columbia (over 2,600 miles) has been sanctioned by the Canadian Parliament a still more rapid increase in telegraphic business appears to be generally anticipated throughout the Dominion.

Notes.

MESSRS. DAVID MOSELY AND SONS, telegraph engineers and india-rubber manufacturers, of Manchester, inform us that they have succeeded, after experiments extending over upwards of twelve months, in finding and adapting for telephonic transmitters a material which will replace carbon with advantage. What the substance is has not been stated, but it is said to possess greater conductivity than any other non-metallic body, carbon not excepted, and a greater variation of resistance under variations of pressure than carbon. The new transmitter, the inventors state, will be found to excel the existing carbon arrangements. The material is said to be harder and therefore more durable than carbon. Patents for the invention have been applied for in various countries.

PROFESSOR TYNDALL is delivering a course of six lectures on Paramagnetism and Diamagnetism at the Royal Institution, Albemarle Street. The lectures commenced on Thursday, April 28, and will be continued every Thursday up to June 2.

THE electric railway is now laid down in the grounds of the Crystal Palace.

THE Manchester, Sheffield, and Lincolnshire Railway station, and that of the Midland, at Sheffield, are to be connected with the Telephone Exchange on the 1st of June. Eight hundred and sixty-eight purely business messages passed through the Sheffield Telephone Exchange on a single day last week. The total for the week was 4,400.

AN Italian journal states that Signor Manet whitens the albumen of blood by means of the electric light. In general, 24 hours suffice to give complete decolouration.

THE New York Electrical Society, recently formed, now numbers over 200 members.

MESSRS. LUND AND BLOCKLEY, clock and watch manufacturers, 42, Pall Mall, have recently applied their synchronising system to the Ludgate Hill platform clock of the Chatham and Dover Railway, by which it will be set to true time by an electric current from Pall Mall at 10 a.m. daily. They have also applied to the clock a novel automatic arrangement of their own invention, by which, at two minutes to 10 a.m. daily, the current will ring a warning bell, couple up and block against false currents two ordinary working telegraph lines, one in use from Victoria to Ludgate Hill, with intermediate stations, and the other from Kentish Town to Waterloo, passing through Ludgate Hill and jointly worked by the Chatham and Dover, the London and South Western, the Great Northern, and the Midland Railways. At 10 a.m. Messrs. Lund and Blockley's standard clock in Pall Mall, through a line—also automatically joined up with the Victoria and Ludgate line by a clock in the telegraph office at Victoria—will send an electric time-current of two seconds' duration, giving the time to these different railways. The current will set to true time—minutes and seconds—the clock at Victoria, the clock at Ludgate Hill, and a local standard for the use of the Great Northern Railway at King's Cross. Immediately upon the termination of the two seconds' time-current the three lines will be automatically re-established as

distinct lines for their ordinary telegraph purposes. No false current can by any possibility actuate the clocks, nor during the rest of the twenty-four hours can the clocks interfere with or be interfered with by the ordinary operations of the circuits. The principle of Messrs. Lund and Blockley's system is that of dropping a small weighted lever exactly at the hour, this lever grips the minute hand and sets it exactly at the hour division on the dial. The weighted lever is brought back in position by the going weight of the clock between each hour, and is released at the hour by an electro-magnetic detent.

MESSRS. BARRAUD AND LUND, of Cornhill, have devised an ingenious system of automatically testing and reporting the condition of the time wires by which their system of synchronising clocks is carried on. Their "fault-finder" for main lines is an alarum, and a series of indicators representing any number of trunk lines; so long as the various time signals are duly transmitted no indication is made, but failing any one of the trunk lines to receive its hourly signal, five minutes afterwards the alarum is rung, and a number is dropped indicating the particular line in default. This is the first time, we believe, that any instrument has been devised for making a telegraph line, absolutely broken down, report its own breakage. The "fault-finder" for branch lines indicates twice a day whether such lines are in working order, such indication from any number of branches being nevertheless transmitted over the single main trunk.

THE TELEGRAPH IN JAMAICA.—The postal telegraph service in the island of Jamaica comprises 32 stations, and employs 35 female operators. There are about 470 miles of wire now in use, which completely encircle the island, connecting all places of sufficient importance to require telegraphic facilities. The lines are under the superintendence of Mr. H. C. Wilson, an experienced telegraphist, who was first employed with the old Electric and International Telegraph Company, in England, subsequently serving three years in Egypt, and three years or more under the Western and Brazilian Company, at Pernambuco and Bolivia, about fourteen years in all. Mr. Wilson has superintended the construction of the lines, the opening of the offices, and the teaching of the operators. The lines are worked on the open circuit system, using Morse sounders and Siemens relays.

IMPROVED INCUBATOR.—An improved incubator, which regulates its temperature and shifts the eggs automatically at regular intervals, has recently been patented in America. It is provided with a series of longitudinal cloth hammocks or egg receivers, attached to end pieces pivoted to rigid supports and to movable bars, which are automatically moved so as to shift the eggs at regular intervals by suitable levers controlled by clock-work. The gas or oil cock of the flame of the boiler for heating the incubator is controlled by means of a pair of electro-magnets connected with a battery, and with a metal thermometer provided with an adjustable scale, so that the temperature of the incubator is regulated automatically.

A RECENT experiment by Professor Marangoni seems to prove that moist air cannot be regarded as an electrical conductor. A vessel of water heated over a lamp gives off steam through a bent tube passing to a bell jar through stoppers in each vessel. The bell jar, supported in an inclined position, thus gets filled with moist air. A small, fully-charged Leyden jar is pushed (the upper half of it) into the bell jar, and kept there four or five seconds. On removal it is found completely discharged. But that this discharge is due to a layer of water formed by condensation on the inserted jar, and superficial conduction by this layer, appears if the jar, before charging, be passed several times through the flame, so as to heat it to about 100° C. Repeating the experiment, the jar then suffers no apparent loss by remaining five seconds in the moist air; on withdrawal it will give a spark as long as when not submitted to the moisture. The hot state of the insulating surface prevents the condensation that occurred in the other case.

THE aldermen of New York have passed over the mayor's veto, the Ordinance giving the Edison Electric Lighting Company permission to lay tubes in the streets. The company will proceed immediately to introduce its new electric lamps in the offices in the business portion of the city around Wall Street. Wires have already been put into forty buildings. The Company will compete with the gas companies by charging the same rates. If the latter reduce, the Edison Company will also reduce, and, it is stated, are prepared to go lower than the gas companies can.

MESSRS. WILSON AND CAMMELL, of Dronfield, are making preparations for lighting their extensive steel and iron works with the electric light.

M. D'ABADIE gives an account of an instance of lightning unattended with thunder, which he witnessed in Africa, December 1, 1845. A mist, which filled a little valley close at hand, was illuminated by a sheet of flame, fainter at its margins and not extending to its utmost limits.—*Comptes Rendus.*

ON THE VOLTAIC CONDUCTIVITY OF HEATED GASES.—M. R. Blondlot.—Gases are generally considered incapable of transmitting the current furnished by a battery of several elements, except when raised to redness, as observed by M. E. Becquerel (*Annales de Chimie et de Physique*, ser. iii., vol. 39, p. 355). The accuracy of Becquerel's experiments has been called in question, and the author has, therefore, re-examined the entire question. He has demonstrated that gases become conductive at temperatures much below redness, even at 60—70° C. Any agitation of the air prevents the manifestation of the phenomenon.—*Comptes Rendus.*

ON THE INTERNAL DISCHARGES OF ELECTRIC CONDENSERS.—By M. E. Villari.—On discharging a strongly charged battery there is produced in its interior a characteristic sound. The glass of the jars on the margin of the coatings is brightly illuminated, and there is a disengagement of heat, as shown by the insertion of a suitably arranged air thermometer. There is consequently, in addition to the ordinary external discharge of the jar, another in its interior, which takes place along the sides of the condenser where not coated. The author has arrived at the following conclusions:—The heat developed by the internal discharge may be neglected in case of slight discharges, but beyond certain limits it becomes manifest and increases very rapidly with their strength; thus the first means of augmenting the internal heat is to make use of jars charged to a very high potential. The internal discharge is sensibly increased if the external spark is taken between two small balls, of 20 to 30 millimetres in diameter, and it is lessened by nearly one-half if the spark strikes between one of the balls and a point. The internal discharge is augmented

for one and the same charge if we diminish the internal coating of the jar, and it is lessened if the coating is increased. The internal discharge diminishes to zero if the resistance of the exterior circuit is much increased. It is, other things being equal, a little stronger if the internal coating consists of mercury. —*Comptes Rendus.*

AT a meeting of the Royal Society of Edinburgh, held on the 18th ult., Sir William Thomson, on taking the chair, congratulated the society on the presence of Professor Helmholtz among them, and said he had the still greater pleasure of announcing that the Professor had agreed to give them a paper that evening. Professor Helmholtz, who was received with applause, stated to the society the results of certain later experiments which he had made in working out his theory of electrolytic convection—experiments which, he said, had succeeded better than his former ones had done. He had entered upon his experiments on account of certain objections that had been made to Faraday's electrolytic law, in connection with experiments which showed that a very feeble galvanic current could be kept up by moderate electromotive force between platinum plates dipped in a slightly acidulated solution, even if the electromotive force of the battery was not sufficient to decompose water. He had found in his earlier experiments that the only effect of the current was to absorb oxygen given off from the atmosphere, and to form a new portion of water, and that the whole electrolytic effect was not to decompose water and to produce a new quantity of elements —hydrogen and oxygen—but only that on the surface of one plate of platinum oxygen was collected and taken away from the surface of the other; he had, therefore, called these currents electrolytic convection. It was not really a decomposition, but only a transport of one of the products of electrolytic decomposition from one plate to another. In his later experiments he had got rid of the atmospheric oxygen by inclosing the whole electrolytic fluid in a solid glass vessel. As a result, he had found that with the smallest electromotive force, down to the one-hundredth or one-thousandth of a Daniell's cell, there was no trace of a continuous current passing through the voltameter, but a strong deflection for a moment, which, after some oscillations of the magnet became zero, although the electromotive force was still acting. If the circuit was broken, a contrary current of the same duration as the direct was observed. Sir William Thomson, in speaking on the paper, stated that Professor Helmholtz's theory of electrolytic convection formed quite an era in electrolytic chemistry. A communication was afterwards read by Prof. Blyth "On the Causes of Sounds produced in an Ordinary Microphone Receiver." For simplicity it was assumed that what takes place at the receiving end when sounds are reproduced is mere make and break. When two carbon points touch each other we may consider them as two fine wires. A spiral of platinum wire through which a current could be sent was inclosed in a tin box. When an interrupted current was sent through the wire the sounds from a tuning-fork were heard coming from the box. Mr. Preece (TELEGRAPHIC JOURNAL, vol. viii., p. 205) suggests that wires conveying currents are heated and cooled, and as the variations in the strength of the current are small compared with the strength of the current itself, the expansion and contraction vary in the same ratio as the condensation and rarefaction of the air particles conveying the sonorous vibrations. If the air contracts and expands, its volume will be made bigger and less. If the volume is actually made bigger and less the volume as a gas will as a whole be made less or more. To find if there was expansion and contraction coal gas was allowed to enter a receiver, and by means of a small jet and revolving mirror the action of the current on the flame when the tuning-fork was set in action was observed. Not the slightest up and down movement of the flame could be detected, the flame being continuous, whether joined up or not. The action in water was next tried. The sounds of the tuning-fork were distinctly heard, but mixed up with a little hissing noise. The water, however, could not be seen moving; there was a slight elevation of the water, due to the heating of the wire going through it. Mercury was afterwards tried. When an interrupted current was sent the sounds could be heard, but accompanied by dull sounds. A source of fallacy suggested itself here, and Prof. Blyth constructed a telephone in the stem of which a cylindrical hole of one inch diameter is cut. The diaphragm is of tin. In the centre of the diaphragm there is a copper wire, which dips in mercury. The mouthpiece is of the ordinary pattern. When an interrupted current was sent, the diaphragm works up and down, and the sounds are perfectly heard. Whether or not the sounds produced in a microphonic receiver are due to condensation and rarefactions, it was impossible to discover any increase of volume.

A PUBLIC meeting has been held at Lerwick to protest against the Postmaster-general's refusal to give direct telegraphic communication with the mainland. An influential deputation has been sent to London to make further representations and urge a reconsideration of the decision.

GREENOCK steamboat quay has been lighted experimentally by electricity—four lamps are used. The result is entirely satisfactory.

FRANCE has now three electrical periodicals, a new one having appeared during the last month under the title of *L'Electricien*. We notice among the writers in the first number the names of MM. A. Niaudet, Gaston Tissandier, E. Mercadier, C. M. Gariel, Dr. de Cyon, and also that of M. Hospitalier. The latter occupies the position of *secrétaire de la rédaction*. It is intended that the paper shall be published on the 1st and 15th of each month. The price per copy is one franc.

AT a meeting of the London Gas Light Company held on the 13th ult., Mr. Robert Rawlinson, one of the directors, expressed his belief that the movement as to the electric light would put gas manufacturers on their mettle, and make them produce the article of the best quality, and to see that the best fittings were used. There ought to be no jealousy between the companies and the consumers. It must be borne in mind that the electric light was useful for certain purposes. He was not so ignorant or so prejudiced as to believe that it would go backward; on the contrary, he thought it probable that the electric light would accomplish considerably more than they had yet seen; but, at the same time, he did not believe that it would seriously interfere with the profits of gas making if gas makers were true to their own interests.

HERR FRIEDRICH SIEMENS, of Dresden, has devised a gas-burner of remarkable intensity. He maintains a high temperature by introducing air previously heated by the waste heat of combustion. A burner of 500 candle-power has been produced, and it is stated the quantity of gas used is small. Seeing that combustion is quickened by hot air, we cannot understand this.—*Athenæum.*

SHEETS numerously signed of the national petition in favour of telegraphic communication between the light-ships around our coasts and the shore have been forwarded to Mr. Hobbs, of Ramsgate, by the Mayor of Gateshead and other gentlemen in various parts of the kingdom. In a pamphlet addressed by the philanthropic promoters of this reform to mayors, yacht and sailing clubs, and persons interested in mercantile pursuits, attention is directed to the loss of the *Indian Chief* on the Long Sand, when only eleven lives were saved out of twenty-nine; to the recent wreck of the Dutch fishing smack on the same spot, when only one out of seven was saved; and to the fatal loss of the *Nymphæa* on the Sunk Sands with all hands. These instances are considered to be striking proofs of the importance of this movement. In the second case the one sailor saved had been clinging to the mast for nearly four days.

MR. J. SLATER on Monday, the 25th ult., read, before the Institute of British Architects, a paper on the subject of "Electric Lighting as applied to Public Buildings."

ACCORDING to a report from Vienna the first step towards the practical application of the invention of telephones has at last been made in the Austrian capital. The Vienna Local Telegraph Company has applied for and has been granted a concession to establish telephonic communication in the city. In granting the privilege the Government has made two conditions—firstly, that the subscription should be as low as possible; and secondly, that telephonic communication should in certain cases come under control, as is the case with telegraphic communication. The first condition has been fulfilled already by the company intending to limit the amount of subscription to from 100 to 140 florins a year.

M. J. B. DUMAS, the distinguished *savant*, gave a lecture recently in Paris to the National Industry Encouragement Society on the experiments of M. Camille Faure and M. Reynier for rendering electricity portable. They claimed to have solved the problem of storing up electricity in a reservoir so as to transport it and employ it for illuminating or other purposes, and M. Dumas spoke very highly of their investigations.

ON THE CONSTRUCTION OF PHOTOPHONIC SELENIUM RECEIVERS.—By M. E. Mercadier—These receivers are formed by taking two bands of brass, $\frac{1}{10}$ millimetre in thickness, 0·01 metre in width, and varying from 4 to 5 metres. They are separated by two bands of parchment paper of about 0·15 millimetre in thickness. The whole is rolled up in a spiral as tightly as possible, and fastened by means of two pieces of wood held by two screws. The two surfaces are smoothed off with the file. The apparatus is heated in a sand-bath, or on a thick sheet of copper placed above a Bunsen burner, to the point at which selenium begins to melt. A stick of selenium is then rubbed over the surface, forming a layer, as thin as possible, of the characteristic slatey tint mentioned by G. Bell. These receivers are continuous, and their construction is extremely easy. They may be polished with the file, and any defect is very easily repaired. They may be made with a very small surface, which permits them to be readily placed in a complex apparatus. They have the same properties as the ordinary discontinuous receivers, plane or cylindrical. The surfaces may be preserved by covering them with a sheet of mica, or more simply by giving them a coat of lac varnish. They may have a very variable resistance, from 8,000 to 10,000 ohms up to 200,000, without their ceasing to act well. Hence results the possibility of placing in their circuit, which contains the battery, a sufficiently large number of telephonic receivers, the resistance of which may, without inconvenience, reach up to 200 ohms, which enables the photophonic effects to be heard by a great number of persons at once. One of these receivers, of 7 centimetres surface, gives in a Gower telephone of 235 ohms resistance, sounds which can be heard at the distance of two or three metres.—*Comptes Rendus.*

M. A. TRÉCUL in a communication to the Paris Academy of Sciences, describes a curious electric phenomena which he witnessed August 25, 1880. A very brilliant luminous body of a pale yellow colour, almost white, issued from a dark cloud. It had a well-defined outline and was of a longish form with conical ends. It disappeared almost instantly, re-entering the cloud, but left behind it a small portion of its substance which fell vertically, like a heavy body, as if under the sole influence of gravitation, leaving behind it a luminous train, and finally breaking up into fragments. No sound was heard either at the moment of its departure or of its division.—*Comptes Rendus.*

ON CAUSES WHICH INTERFERE WITH TELEPHONIC TRANSMISSION.—M. A. Gaiffe.—Having remarked that telephones transmit along with speech sounds of an unknown origin, the author has undertaken experiments in order to find out if the causes of these sounds are not those which oppose telephonic communication at great distances. To eliminate all possible sources of error, the following arrangement was adopted. A line of 20 metres was laid on the floor of several rooms, all the doors of communication being closed. It was connected at one end to a pair of telephones by means of flexible conductors, designed to arrest sounds which might communicate themselves mechanically along the metal to the telephones. The circuit was completed between these conductors by another flexible wire, on the path of which was an interruption-pedal, rendering it possible to cut the circuit without changing at all the nature of the communications between the line and the telephones, and to prove that the sounds heard had an electric origin. The operator acted at the other end of the line which was not connected, directly or by induction, with any electric generator. He observed that the current produced by the friction of two wires of the same kind or of different kinds and that produced by closing a pressure screw were heard in the telephones. It is easily understood that when suspended, telegraph wires serve for telephonic transmission; this cause may occasion much trouble, since these lines are formed of pieces of iron wire connected to each other and to the stretchers by ligatures, more or less perfect, which are in a state of constant agitation. But this cause of failure may be removed by soldering the wires instead of tying them. Unfortunately, there is another cause: the currents due to the influence of the vibrations themselves. To verify this hypothesis, the author placed in the circuit, at the end opposite the telephones, a rod of iron 1·50 metre in length, and connected to the system by supple conductors. This rod was struck sometimes tranversely and sometimes longitudinally with a hammer. The sounds occasioned by the blows were distinctly reproduced by the telephones with their peculiar characters. This experiment, if repeated with copper or brass rods, gave merely negative results. It seems that the phenomenon is only produced as an effect of the vibrations occasioned in the wire. Future experiments must decide whether it is due to a molecular change which the metal undergoes or to a

peculiar action. If, as it is probable, the vibrations caused by the wind act upon the lines of iron wires like the blows upon a rod, it appears difficult to correspond at great distances with the existing means of transmission, till a method has been found of causing the telephones to speak by the aid of electric action so powerful that the currents arising in the line itself cease to be an appreciable cause of disturbance.

AT the meeting of the Société de Physique, March 18th, M. Baillehache exhibited a printing telegraph. The manipulator is an inverter, each letter being successively produced by a positive or negative current, and the impression is effected by the interruption of the current on a band of cloth, which advances by the space of one letter when the current is re-established by the transmission of the following letters. With this apparatus the Crédit Lyonnais sends daily the course of the Stock Exchange simultaneously to its seventeen branch offices at present in activity.

MEETING, APRIL 1ST.—M. Mercadier exhibited the results of his researches on radiophony produced by means of selenium. M. Mascart exhibited a registering electrometer and a magnetometer. M. de Mersanne exhibited a voltaic arc electric lamp, moved by clockwork and fitted to serve for a long time. The system is arranged for alternative currents, and the regulation is obtained by means of a derivation coil and an electromagnet, which keeps the arc constant by reacting on the clock movement which governs the advance of the carbons.—*L'Electricien.*

ON March 30th experiments were made in the hall of the Athenæum in order to show that the electric light, especially on Werdermann's system, is easily adapted to all the requirements of theatres.—*L'Electricien.*

THE ECONOMY OF THE ELECTRIC LIGHT.—By M. A. VANDERPOL.—On a circuit of Siemens machines with alternating currents (hitherto these lamps have only been constructed to work with currents of this kind, though they could give the same results with continuous currents) as many as twenty luminous foci have been placed, though practically the number of ten is not exceeded. A current which commonly serves for four Jablochkoff candles may supply seven or eight Siemens lamps of equal intensity. When in one and the same circuit the number of lights is increased, for instance, to nine or ten, the intensity of each is diminished, though the total yield of light is increased. The motive force exerted is also increased. Whilst we must allow at least one horse-power for Jablochkoff candle, the force necessary for a Siemens burner is half a horse-power. As to the question of expense, the author shows that the carbons used in the Siemens lamps are 10 millimetres in diameter and 20 centimetres in length, which, taking account of waste, gives an hourly expense per light of 12 to 15 centimes, and gives light for 5 to 6 hours. The luminous intensity, according to the number of lamps, is = 25 to 50 gas jets, and averages = 35. Taking account of first cost of the plant, and calculating 600 hours of light yearly, the expense, including the motive power, is about 33 centimes per hour. But 33 centimes is the cost of 8 gas jets, not including the interest on first outlay. In most workshops it is possible to substitute one electric lamp of this intensity for 8 gas jets. This is, therefore, the present state of the question: the electric lamp gives four times more light for an equal expense.—*Le Technologiste.*

SASSERATH'S IMPROVEMENTS IN TELEPHONES.—The author (German patent, No. 11,477) uses instead of a metallic membrane one of mica, wood, or other non-conductive matter, which he connects with the inner pole of a horse-shoe magnet, terminating in a metallic tongue, by means of an interposed cube of caoutchouc. This cube is fixed in the centre of the membrane, and transfers the vibrations of the latter to the metallic tongue. The other pole of the magnet is provided with a wire coil, the nucleus of which is prolonged up to the metal tongue, so that both poles are within the magnetic field. If the membrane of the transmitter is set in vibration, such vibrations are communicated to the metal tongue, and according to the extent or strength of its vibrations the magnetic force and the strength of the induction current vary. These fluctuations in the strength of the current produce in the receiving telephone a corresponding variation in the strength of the magnetism in the coil, and the tongue and membrane of the receiving apparatus are thrown into corresponding vibrations and reproduce the sounds uttered. The pressure of the caoutchouc cube upon the membrane is regulated by a screw acting upon the magnet, in opposition to which a spring tends to withdraw the magnet from the membrane.—*Electrotech. Zeitschrift.*

LEHMANN'S TELEPHONIC APPARATUS.—(German patent, No. 11,595.)—This invention is based upon the fact that a carbonaceous or metallic powder in a loose condition is almost a non-conductor of electricity if the latter is not of strong tension, whilst in a compressed or at least strongly compacted state it becomes a relatively good conductor. The patentee constructs an apparatus to increase the action of sound in the telephone. He utilises this property of such powders by inclosing them in elastic receptacles and introducing them along with a common telephone into the circuit of a battery in the following manner:—To the centre point of the membrane of a telephone there is soldered, pointing downwards and exactly vertical to its plane, a well-polished steel needle, tapering off in an accurately conical manner. The point of this needle pierces a stopper of soft caoutchouc as near as possible to the membrane, and containing in a cavity, opening downwards, a powder of charcoal and silver, containing about 75 per cent. of carbon and 25 of silver. This stopper is inclosed in a brass case, which allows it a certain room for expansion and which is closed from below by a brass screw, the conical end of which projects into the powder and exerts a certain pressure upon it. This screw is connected with one of the polar wires, while the other is connected with the metallic membrane. When the latter vibrates, the needle penetrates alternately into the powder and is drawn back, alternately compressing and loosening it. In this manner the inventor seeks to effect a rapid alternation in the conductivity of the powder corresponding to the vibrations of the membrane, and thus to produce variations in the strength of the current, which are to produce an exact reproduction of the sounds in the receiving apparatus.—*Electro-techn. Zeitschrift.*

IN a paper recently read by M. Bartelous before the scientific section of the Syndical Union of Brussels, it was stated, on the evidence of statistics, that with the most perfected systems serious fires were reduced to 4 per cent.; with systems of telegraph lines, but without alarms, they still reached 17 per cent.; while without telegraph offices they reached 27 per cent. M. Bartelous recommended that the telegraph offices now open be authorised to transmit alarms of fire free of cost to the sender, and that this use of the offices be indicated by placards.

AT the close of the year 1880 the lengths of telegraph lines in various parts of the world were as follows: United States, 171,103 miles; Russia, 56,170 miles; Germany, 41,431; France, 36,970; Austria-Hungary, 30,403; Australia, 26,842; Great Britain, 23,156; British India, 18,209; Turkey, 17,085; and Italy, 15,864.

THE summer course of the Technical Science Classes of the City and Guilds of London Institute will commence in May. The course will include "Electrical Instrument Making," introductory and advanced, and the "Electric Light," by Professor Ayrton. The following are the subjects dealt with:—

ELECTRICAL INSTRUMENT MAKING. INTRODUCTORY COURSE.—*Construction of Statical Electrical Apparatus.*—Meaning of an electrified body, conduction, insulation. Leakage through the insulating material, surface leakage, laws of. Leakage in artifically dried spaces, modes of effecting such artificial drying. *Insulating supports*, how they are usually made, their faults, how they should be made. Positive and negative electricity. Equal quantities of the two kinds always produced simultaneously. *Quantity* and *density* of electricity, mode of measuring. Induction. *Electroscopes*, ordinary method of constructing, faults usually existing, proper method of constructing. Electric *potential*, analogy with level or pressure. Electroscopes indicate differences of potential. Electromotive force. Density varies over a conductor, potential remains constant. Amount of work stored up in a charged body. Electric *capacity*, measurement of; Leyden jars. *Specific inductive capacity*, measurement of; condensers, practical detail of construction. Effect of time-of-charging on the capacity of a condenser. Absorption of charge, residual charge. Leakage from a Leyden jar, how to reduce to a minimum, resistance of different substances to conduction or to disruptive discharge. Production of electricity. *Frictional machines*, theory of their construction, usual defects, how some of the defects may be remedied. Source of energy in the so-called frictional production of electricity. *Induction machines*, Varley's, Thomson's, Holtz's, Toepler's; details of construction, mode of using, superiority to frictional machines. Electricity produced by a machine compared with that produced by a voltaic cell. *Electrometers* measure difference of potentials. Peltier's, Bohnenberger's and Thomson's electrometers; details of construction, possible improvements in construction. Absolute, portable, and long range electrometers. Use of high electromotive force machines for telegraphy, cause of failure. Possible future employment of the Holtz machine for the electric transmission of power to long distances. Insulation of gases at various pressures. Practical use of results, &c.

ELECTRICAL INSTRUMENT MAKING. ADVANCED COURSE.—*Resistance Coils.*—Resistance of a wire depends on its length, diameter, material, purity, hardness, temperature, age, &c. Choice of material and size of wire. Winding coils, insulation of; proper method to insulate ends. Testing coils; temperature corrections. Variation of temperature, correction in different parts of the same coil of wire. Permanency of resisting power; annealing by time; artificial annealing of finished coils. Baking coils. Exterior of coil-box; objection to highly-polished ebonite; insulation of. Suitable coils to form a set. Plugs, revolving arms, slides. Thomson's and Varley's sliding coils, principle of; construction of circular forms. Standard coils, the ohm, connection with the theoretical standard, construction and testing of. Defect in standard coils as commonly made. Hermetically-sealed coils. Method of constructing cheap accurate resistance coils; coils for very strong currents such as are produced by dynamo-electric machines, &c.

Condensers.—Construction of; materials employed. Necessity of drying the insulating compounds. Injury done by overheating a dielectric. Modes of purifying paraffin, shell-lac, &c. Capacity of a condenser depends on the area of the conducting coatings, the thickness, nature and temperature of the dielectric. Practical methods of measuring the capacity and insulation of condensers. Adjustment of capacity. Effect of residual charge, how to diminish. Manufacture of condensers to be used with very high electromotive forces. Absolute condensers with calculable capacity, construction and practical use of, &c. Artificial cables, use and construction of. Tests of capacity; insulation of the dielectric, and resistance of the conductor. How to adjust each. Outside of condenser boxes; proper mode of making the terminals, &c.

Induction Coils.—Fundamental principle of. Use of iron wire core. Time of magnetising and demagnetising of iron. Quantities of electricity induced on making and breaking the primary circuit equal to one another, but the electromotive forces of the two induced currents very unequal. Proper resistance to give to the primary and to the secondary coils. Mode of winding the wire to secure high insulation, and to obtain maximum effect; shape of coils; actual results obtained with ring-shaped core. Contact makers; usual forms modes of varying speed of making and breaking the circuit. Improvements that can be effected by using automatic current reversers. Use of condenser with primary circuit, and with secondary circuit. Experimental determination of the efficiency of induction coils. Employment of induction coils in electric lighting, and in chronographs for measuring very small intervals of time. Duration of the spark discharge.

Telephones.—Principle of small recurrent effects. Early forms of telephones. Improvements introduced by Bell. Dead-beat effects produced by lightness and rigidity of iron membrane. Reason for using a flat coil wire. Edison's telephone, use of induction coil, details of construction. Ader's simple wire telephone, principle of. Gower-Bell telephone, construction of the horse-shoe permanent magnet, and kind of steel employed. Hughes' induction balance, theory of its action; mode of construction. Connection of its indications with the resistance and self-induction of the substance experimented on.

THE ELECTRIC LIGHT.—Heat produced by an electric current. Meaning of an electric current and the direction of flow. Current proportional to chemical decomposition. *Electromotive force.* Ohm's law. Analogy, and want of analogy of an electric current with a stream of water. Heat produced when a resistance or an electromotive force is overcome.

The Electric Arc.—Temperature very great, and yet heating of surrounding space small, reason of this. The electric light, and electric furnace, reason of present economy compared with former want of economy. Resistance of arc, opposing electromotive force set up in the arc. Dead-beat absolute galvanometers for measuring strong currents. Horse-power expended in the arc. Measurement of light. *Photometers*, Bunsen's, Ayrton and Perry's, &c. "Arc horse-power measurer." Amount of light per horse-power expended in the arc for different currents, thicknesses of carbons, and length of arc, &c. *Electric lamps*, principles of the more important, Foucault's, Serrin's, Dubosco's, Siemens', Crompton's, &c. *Electric candles*, Werdermann's, Jablochkoff's. Efficiency of the various kinds. *Vacuum lamps*, Edison's, Swan's, Lane Fox's. Life of vacuum lamps. Current and electromotive force necessary to

maintain a given conductor at a given temperature. Relative economy of lighting by the arc and by incandescence. Combination of the two methods. *Carbons*, manufacture of, and resistance of different kinds. *English patents* regarding electric lighting. *Generators* of electric currents; batteries, description of the more important and their defects. Great efficiency of constant batteries. High price per pound of fuel consumed. Direction in which improvements may be looked for in batteries. *Magneto and dynamo-electric machines*, fundamental principles of the more important, Wilde's, Holmes's, Siemens', Gramme's, Lontin's, &c. Constant current, improvements to be made in the commutators, reverse current producers. Measurement of efficiency of current generators, force dynamometers, Alteneck's, Ayrton and Perry's; actual results practically obtained. Connection between the electromotive force set up, the current generated, the resistance in circuit and the speed. How the results are effected by using a separate exciter. Coercitive force of the revolving iron armature. Saturation of inducing magnets, direction in which improvements may be looked for in magneto and dynamo-electric machines. Proper employment of the electric light, possibility of subdivision. *English patents* regarding dynamo and magneto-electric machines.

It is a matter of importance that it should be known that the above exhaustive course is open for an almost nominal fee to female as well as to male students.

ON THE CHANGE OF VOLUME WHICH ACCOMPANIES THE GALVANIC DEPOSITION OF A METAL.—By M. E. Bouty.—In previous notes I have established, 1st, that the galvanic depositions experience a change of volume, from which there results a pressure exercised on the mould which receives them; 2nd, that the Peltier phenomenon is produced at the surface of contact of an electrode and of an electrolyte. Fresh observations have caused me to believe that the two phenomena are connected, and that the first is a consequence of the second. The Peltier effect can clearly be proved when the electrolysis is not interfered with by energetic secondary actions, and particularly with the sulphate and nitrate of copper, the sulphate and chloride of zinc, and the sulphate and chloride of cadmium. For any one of these salts it is possible to determine a value, I, of the intensity of the current which produces the metallic deposit such that, for all the higher intensities the electrode becomes heated, and such that it becomes cold for less intensities. I will designate this intensity, I, under the name of *neutral point of temperatures*.

The new fact which I have observed is, that in the electrolysis of the same salts it is always possible to lower the intensity of the current below a limit, I′, such that the compression produced by the deposit changes its direction, that is to say, instead of contracting the metal dilates in solidifying. This change, although unquestionable, is sufficiently difficult to produce with sulphate of copper. It is necessary to employ as a negative electrode a thermometer sensitive to $\frac{1}{100}$th of a degree, and to take most careful precautions to avoid accidental deformations of the deposit; but the phenomenon can be observed very easily with nitrate of copper, the sulphate of zinc, and the chloride of cadmium. There is, therefore, a *neutral point of compression* in the same cases where there is a neutral point of temperatures. With the salts of iron, nickel, &c., for which the neutral point of temperatures cannot be arrived at, there is also no neutral point of compression; and the negative electrode always becomes heated, and the deposit obtained is always a compressing deposit.

I have determined, by the help of observations made with ten different current strengths, the constants of the formulæ which I have explained elsewhere, and which gives the apparent excess, y, of the thermometer electrode compressed by the metallic deposit in terms of the time, t, during which the metal was depositing:

$$(1) \qquad y = \frac{A\,t}{B + t}.$$

The constant, A, is proportional to the variation of volume of the unit of volume of the metal. The values of A, without being exactly regular, are sufficiently well represented within practical limits by the formula:

$$(2) \qquad A = -a'i + b'i^2,$$

of the same form as the expression E:

$$E = -ai + bi^2,$$

of the heating of the thermometer electrode. Further, every cause which affects the coefficients, a or b, also affects in the same way a' and b': such causes being the greater or less dilution of the solution, the nature of the salt, &c. It is therefore impossible not to be struck by the direct relation of the thermic and mechanical phenomena of which the negative electrode is the origin. The following is the explanation which I offer: The thermometer indicates the mean temperature of the liquid just outside it; this temperature is not necessarily that of the metal which incloses it. The current, propagated almost exclusively by the molecules of the decomposed salt, does not act directly to cause a variation in the temperature of the dissolving molecules; these change heat with the molecules of the electrolyte, which should be in general hotter than those, when a heating is noticed and colder when a cooling is observed. Suppose it is found, in the first case, that the metal, at the moment when it is deposited, is hotter than the liquid, and, consequently, than the thermometer; it becomes colder immediately after the deposit, and consequently contracts; the deposit is compressed. The reverse is the case when the metal is colder than the liquid; the deposit then dilates. If this hypothesis is correct, the excess, T, of the temperature of the metal over the liquid which surrounds the thermometer should be proportional to the contraction, A, represented by the formula (2), and the neutral point, I′, of the contraction corresponds to the case where the temperature of the metal is precisely equal to that of the liquid.

It might be expected, perhaps, from the foregoing, that I′ = I; this would take place if the excess of temperature of the metal, measured by the contraction, were rigorously proportional to the heating of the liquid, for then the two quantities would be null at the same time. Careful experiment proves that this is not the case. The sulphate of copper gives compressing deposits on a thermometer which is undoubtedly cooling; chloride of zinc of a density 200 can give expanding deposits on a thermometer which is heating. There is, therefore, no proportionality; but it must be remarked that the temperature of the metal which is deposited does not depend only on the quantities of heat disengaged in an interval of molecular thickness which is infinitely small compared with the thickness of the layer, of which the variations of temperature are registered by the thermometer. There is nothing surprising, therefore, that the two variations of temperature, according exactly with one another, do not follow identically the same laws.—*Comptes Rendus.*

New Patents—1881.

1550. "Means for protecting magnetic needles from local attraction." J. S. GISBORNE. Dated April 9.

1577. "Improvements in electric telegraphs, parts of which improvements are also applicable to other similar purposes." J. HOPKINSON and A. MUIRHEAD. Dated April 11.

1596. "Electric lamps." A. W. REDDIE. (Communicated by H. Sedlaczek and F. Wiknlill.) Dated April 12.

1613. "Improvements in electrical signalling and tell-tale apparatus, chiefly designed for the use and supervision of watchmen." W. R. LAKE. (Communicated by J. T. Campbell.) Dated April 13.

1624. "Electric telegraphs." A. MUIRHEAD and H. A. C. SAUNDERS. Dated April 13.

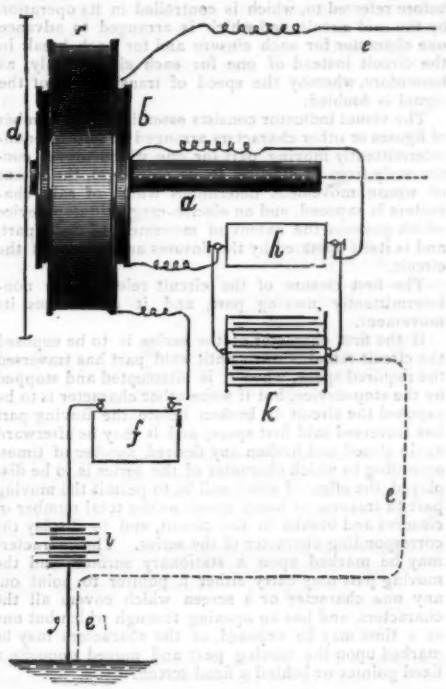
1630. "Improvements in the treatment of ores and compounds containing metals for the separation of the metals therefrom, and the production of electricity and in the apparatus employed therein, and the mode or means of regenerating the agents employed in such treatment." J. H. JOHNSON. (Communicated by N. E. Reynier.) Dated April 13.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1880.

3324. "Electric machines." CHARLES GODFREY GÜMPEL. Dated August 16. 2d. Relates to the construction of dynamo-electric and magneto-electric machines for producing electric currents, or of electro-dynamic machines for conversion of electricity into motive power, and consists chiefly in a special form of rotating armature and a special manner of winding upon it the insulated wire. (*Provisional only.*)

3473. "Apparatus for transmitting and receiving signals." ARTHUR FRENCH ST. GEORGE. Dated August 27. 10d. Relates to novel methods of arrangement of apparatus to be used for the purpose of acoustical telegraphy by means of electricity, and it has for its objects the attainment of greater simplicity and efficiency than in apparatus for similar purposes of the kind ordinarily heretofore constructed and used. *a* is a metallic bar surrounded with an internal coil, *b*, and an external coil, *c*, of insulated wire; *d* is a vibratting diaphragm; *e* is the main line wire, through which the current is transmitted round the external coil, *e*, by any suitable form of transmitting apparatus, *f*, in any desired part of the circuit, the current then passing by the wire, *g*, back through the earth or through a return wire; *h* is a resistance apparatus, the amount of resistance of which can be varied and adjusted as desired, which is placed in the circuit of the inner coil, *b*. *k* is a condenser arranged so that the current through the inner coil, *c*, may be made to pass as desired to it, or through the resistance coil, *h*. The disturbing currents induced in the main line, and which it is desired to suppress or neutralise, pass through the outer coil of the receiving telephone and induce corresponding currents in the inner coil. These induced currents produced as described in the inner coil pass in a direction opposite and opposed to that of the currents passing through the outer coil.

By this means and by suitably adjusting the variable resistance apparatus a certain point can be attained at which the disturbing currents are to a certain extent suppressed or neutralised by the opposing action upon the metallic bar or core, caused by the opposing currents in the two coils surrounding such bar or core, and which bar or core actuates the diaphragm, and consequently the objectionable noises are neutralised. The condenser shown at *k* is not specially necessary for neutralising "induction" noises, but it is found to be necessary for the efficient working of the apparatus upon long lines of any considerable inductive capacity



or other unfavourable electrical conditions upon which retardation of electric currents transmitted is found to take place. The object of arranging the condenser in connection with the inner coil of the receiving telephone, as shown, is to cause an electrostatic induction between the two coils, *b* and *c*, when a current is received in the outer coil, *c*, from the line, *e*.

3494. "Electric lamps, &c." ST. GEORGE LANE FOX. Dated August 28. 6d. Relates to the lamps described in THE TELEGRAPHIC JOURNAL for March 15, page 97.

3505. "Electric signalling telegraphs, &c." WILLIAM CLARK. (A communication from abroad by John Van Dussen Reed, of New York.) Dated August 28. 10d. Relates partly to electric signalling telegraphs and partly to indicators for use therewith, which point out or display one figure or other character of a series, or one character of each of two or more series, and its object is to produce a telegraph and indicator which can be operated with extreme rapidity and which shall be accurate and reliable, displaying always at the indicator the figure or character intended without confusing it with other characters.

The invention is particularly adapted to fire and burglar-alarm telegraphs, and hotel annunciators, and to telephones, although applicable also to other forms of electric signals.

An electric circuit is formed, which includes a bat-

tery, one or more sending stations, and one or more receiving stations. This circuit may be normally either open or closed. Each sending station is provided with mechanism for closing and breaking this circuit a certain number of times in rapid succession whenever it is operated to send a signal, and each receiving station is provided with the indicator hereinbefore referred to, which is controlled in its operation by the said circuit, and which is arranged to advance one character for each closure and for each break in the circuit instead of one for each closure only, as heretofore, whereby the speed of transmission of the signal is doubled.

The visual indicator consists essentially of a number of figures or other characters arranged in series, a non-intermittently moving part (or one which moves continuously from its starting to its stoppage), the extent of whose movement determines which of said characters is exposed, and an electro-magnetic stop-device which governs the extent of movement of said part, and is itself operated by the closures and breaks of the circuit.

The first closure of the circuit releases the non-intermittently moving part, and it commences its movement.

If the first character of the series is to be exposed the circuit remains open until said part has traversed the required space, when it is intercepted and stopped by the stop-device, but if some other character is to be exposed the circuit is broken before the moving part has traversed said first space, and it may be afterward again closed and broken any desired number of times, according to which character of the series is to be displayed, the effect of which will be to permit the moving part to traverse as many spaces as the total number of closures and breaks in the circuit, and to display the corresponding character of the series. The characters may be marked upon a stationary surface, and the moving part may carry either a pointer to point out any one character or a screen which covers all the characters, and has an opening through which but one at a time may be exposed, or the characters may be marked upon the moving part and moved opposite a fixed pointer or behind a fixed screen.

3637. "Lighting cities by electricity." PHILIP MIDDLETON JUSTICE. (A communication from abroad by Henry Curtis Spalding, of the City of Boston, America.) Dated September 7. 6d. Has for its object the lighting of towns and cities by means of electricity with economy, and in such manner as to cast the least possible shadows from the buildings. In order that a town or city may be properly lighted the atmosphere must be flooded with such a quantity of light irradiated in many directions as to reduce to a minimum or practically prevent the casting of shadows; this object is accomplished by the employment of groups of electric lights, each group consisting of a number of lights massed together, supported at a high level, say one hundred feet above the houses, by means of towers of from 100 to 200 or more feet in height, according to the height of the buildings, and by arranging the towers in triangular groups of not less than three towers, whereby the rays of light cast by the electric lights of one tower are caused to cross angularly those cast by the remaining towers; each light tower supports a reflecting lantern containing electric lights.

3670. "Regenerating the fluids of galvanic batteries, &c." ALEXANDER MELVILLE CLARK. (A communication from abroad by Emile Reynier, of Paris, France.) Dated September 9. 4d. This invention consists in a process of regenerating the electrolytic fluids of galvanic batteries in which caustic soda or potash are employed, and of recovering the zinc hydrate which has become dissolved therein, by utilising the property of this oxide of being abundantly soluble in a concentrated caustic soda or potash lye, only slightly soluble in a weak lye, and insoluble in plain water. The process of treating the electrolyte of a battery in which caustic soda or potash is employed, and which has become charged with zinc hydrate by the working of the battery, consists essentially in precipitating the oxide of zinc by the addition of water, reconcentrating and decarbonating the liquid. The insoluble carbonate of zinc which may have been formed by the carbonic acid of the air, or by any carbonates that may accidentally be present with the caustic alkalies, is separated by decantation. To the liquid freed from the insoluble carbonate of zinc are added four to eight volumes of water, which precipitates the zinc hydrate, this precipitation being more complete the more dilute the solution. The zinc hydrate is decanted, collected, washed thoroughly, drained and dried, the dilute lye which has been drawn off is then evaporated and concentrated till it attains its original density. Any carbonic acid the liquid may still contain is eliminated by caustification with lime.

3734. "Appliance for signalling." ALEXANDER MAXWELL RITCHIE. Dated September 14. 6d. Relates to a new or improved construction of signalling appliance, ball, or shape, to be used by ships at sea, particularly as a distress signal, and for ships not under command, in compliance with the Merchant Shipping Amendment Act, but also applicable for storm warning signals on land, and for other signalling purposes. The new or improved signal appliance is specially designed to be readily collapsed, and thus occupy little space when stowed away as compared with ordinary ball signals. The invention consists essentially in forming the improved ball or shape of two hoops of iron, steel, or other rigid metal or material, fitted the one inside the other, and connected together by a swivelling pin on each side, so that the hoops may be either in one plane or opened out in planes at right angles to each other. These hoops are covered with canvas, sail cloth, or other similar material, stitched or otherwise fastened round the rim and extending across each to form a pair of discs, the one disc being complete, whilst the cloth of the other is sewed or attached to the former on either side at or near the axial line of the swivelling pins, so that the two discs can be collapsed to the flat state; and when there are several such balls used for signalling, these can be stowed away in less space than an ordinary ball of the same diameter. The swivelling pins are also formed with eyes outside for attachment to the hoisting ropes or halyards, and a clamp or catch is fitted loosely on one of the centre pins, and fitted with four prongs or other equivalent, which catch on either side of the hoops in their collapsed condition, and this pronged clamp is lifted and replaced to grip each of the hoops when opened out at right angles, and thus hold them firmly in this position, in which the ball or shape is hoisted as a signal.

3808. "Dynamo machines." FREDERIC GEORGE WILLATT. Dated September 20. 2d. An armature having four or more, but preferably six, blades, broad at the outer end and narrowing somewhat towards the centre, is cast in one solid piece. Each blade is wound in the same direction and coupled up so as to form north and south poles across the centre of the armature when in motion, and round the armature extends a stationary soft iron magnet composed of two parts, one acting as N. and the other as S., and preferably circular in form so as to fit round the armature and economise space. (*Provisional only.*)

Correspondence.

ROLLS' METHOD OF TELEPHONING BETWEEN BLOCK SIGNAL CABINS.

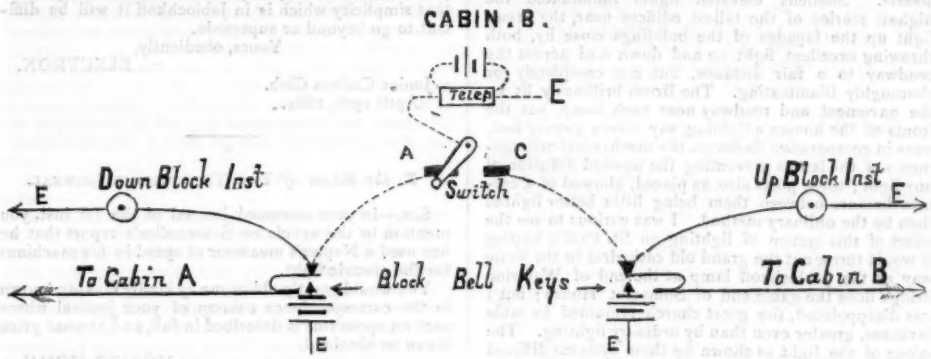
To the Editor of THE TELEGRAPHIC JOURNAL.

DEAR SIR,—I think it may be interesting to some of your readers if I detail the system I have worked out and put into practice for telephoning between block signal cabins.

The great obstacle to overcome was the high cost of saved by making the block wire do dual service, and the cost of a second telephone at each cabin, the expense of which might be prohibitory, is avoided.

The connections are very simple, and may be added by the lineman in half an hour. I give a plan of these beneath; the dotted lines show all that is additional for telephoning upon the existing block instrument connections.

The relative resistances with most forms of block instruments are such that no compensation is required, and difference in the signals upon introducing the telephone is quite imperceptible.



the telephones (Gower-Bell) as compared with the more familiar single needle instrument. The advantages to be gained by the increased facility of verbal communication scarcely need mentioning.

By my method the difficulty is entirely surmounted, and a chain of telephonic communication may be established between block signal cabins at even less cost than the single needle system. All extra line wires, leading in wires (and the single needle battery) are

The switch stands indifferently turned to A or C. When either cabin requires to telephone to B the preconcerted number of beats upon the block bell is given; B reverses the switch if requisite, and receives the message.

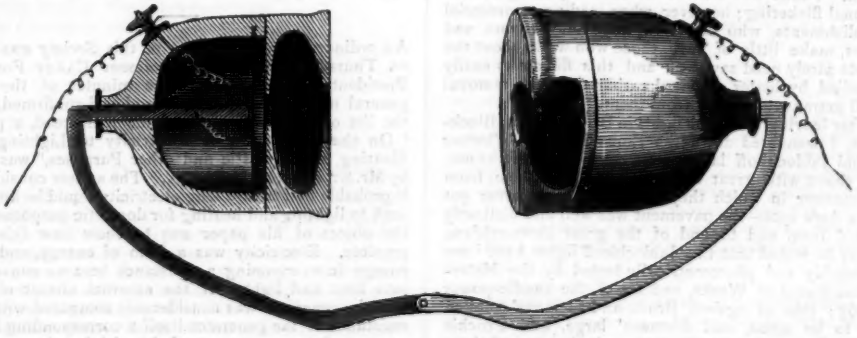
If transmission of the message should be required it can be done *viva voce* with rapidity, but in practice this would be rarely necessary. Yours truly,

E. T. ROLLS.

To the Editor of THE TELEGRAPHIC JOURNAL.

DEAR SIR,—The difficulty experienced in listening to, and writing down, a telephonic communication when the ordinary form of apparatus is employed is well known, for as a rule both hands are employed in holding the two telephones or two ear tubes up to the ear, and consequently the writing down has to be effected by a second person. If one ear only is employed for listening, so that one hand can be at liberty to hold a pen, then the power of hearing is very considerably diminished. The apparatus of which I give a sketch enables two telephones to be secured to the ears, so that the hands of the listener are left free to write.

The mouth-pieces of the telephones are so shaped that they can be slipped over the ears and be held securely there; a metal bar connects the two instruments and lies against the nape of the neck and keeps the whole apparatus steady. I am, Sir, yours faithfully,



London, April, 1881. C. C. VYLE.

[An apparatus very similar to the foregoing was described and illustrated in the number of this journal for December 1st, 1878.—EDITOR TEL. JOUR.]

To the Editor of THE TELEGRAPHIC JOURNAL.

SIR,—The remarks by the press generally regarding the electric lighting of the City are certainly favourable. Some give the palm to one system, some to another, the highest encomium paid being perhaps that regarding the Brockie light at the Cannon-street station. Electric light is, however, electric light, and the favourable progress of one system more or less reflects on all. In watching the general effect of the new light in the City, one was struck with the wide difference between the two systems now tried in the streets. Siemens' elevated lights illuminated the highest stories of the tallest edifices near, the lesser light up the façades of the buildings close by, both throwing excellent light up and down and across the roadway to a fair distance, but not completely or thoroughly illuminating. The Brush brilliantly lit up the pavement and roadway near each lamp, but the fronts of the houses adjoining, say above twenty feet, were in comparative darkness, the mechanical arrangements of the lamps preventing the upward diffusion of any light; these posts also, as placed, allowed of a certain distance between them being little better lighted than by the ordinary method. I was curious to see the effect of this system of lighting on St. Paul's, hoping it would throw out the grand old cathedral in the same way as the Jablochkoff lamp at the end of Waterloo Bridge does the gable end of Somerset House; but I was disappointed, the great church remained in sable darkness, greater even than by ordinary lighting. The colour of the light as shown by these systems differed considerably. The Brockie at Cannon-street station was more like the Jablochkoff on the Embankment, of a yellowish white; the Siemens a pale blue; while the Brush shone with a greeny blue tinge, no doubt owing to the excess in the copper vapour given off, and casting a rather cadaverous look on passers by. One thing the City lighting undoubtedly does, it demonstrates the considerable improvements of late in "regulator" lamps; but for an electric light for the streets, or where the supervision can be but very general, extreme simplicity is the desideratum. Now the first system practically tried was the Jablochkoff. It has stood two years, including three winters of great severity, on a most exposed and trying position; it would now, but for legal proceedings, be lighting Queen Victoria-street, City, though it needed not any trial to show its merits or its worth. Faults are laid to its door regarding the occasional flickering; however, when leading commercial establishments, who use it in their show-rooms and offices, make little of such, those who walk about the streets surely need say less; and this flicker is easily remedied by better prepared carbons and the removal of all extraneous matter from them.

After leaving the Brush lights in Bridge-street, Blackfriars, I wandered down the Embankment. Whether the old Jablochkoff lamps were on their mettle or not, they shone with great brilliancy, and with them, from the manner in which they are placed, one never got into a dark spot—the pavement was well and distinctly lighted from end to end of the great thoroughfare. It may be stated that the Jablochkoff lights have been thoroughly and photometrically tested by the Metropolitan Board of Works, and are of the candle-power of 265: this as against Brush and Siemens' smaller, said to be 2,000, and Siemens' large, and Brockie 6,000. I am not aware, however, whether any of these have been subjected to any crucial test as to light power. The Jablochkoff system as compared with all others, superior or inferior to it in light, possesses what no other has, viz., simplicity. Every other system depends upon some clock-work or other mechanical contrivance, with or without magnets, &c., to keep the poles at their proper distance, the Jablochkoff —nothing: simple as the placing of a taper in a candlestick and manageable by a child. When the battle of the lights is fought out and novelty ended, simplicity and economy become a desideratum, this invention of the Polish engineer, which has served our finest thoroughfare for two years, and well, will, so far as present practical working indicates, I opine, find itself, if not the only reliable system, at least at the head of a list which, to judge by appearances, seems likely to be steadily added to monthly. Mechanism can be improved, so can the purity of carbon manufacture, but that simplicity which is in Jablochkoff it will be difficult to go beyond or supersede.

Yours, obediently,

ELECTRON.

Junior Carlton Club.
April 19th, 1881.

To the Editor of THE TELEGRAPHIC JOURNAL.

SIR,—In your esteemed journal of the 1st inst. you mention in the article on Schwendler's report that he has used a Napier's measurer of speed in his machines for the electric light.

You would greatly oblige me by kindly making known in the correspondence column of your journal where such an apparatus is described in full, and at what price it can be obtained.

MORITZ KOHN.

Vienna, April 19th.

[Perhaps some of our readers will oblige with the desired information.—ED. TEL. JOUR.]

Proceedings of Societies.

THE SOCIETY OF TELEGRAPH ENGINEERS AND OF ELECTRICIANS.

AN ordinary general meeting of this Society was held on Thursday, April 14th, Professor CAREY FOSTER, President, in the chair. The minutes of the last general meeting having been read and confirmed, and the list of new and proposed members read, a paper "On the application of Electricity to Lighting and Heating for Domestic and other Purposes," was read by Mr. ST. GEORGE LANE FOX. The author considered it probable that before long electricity would be applied both to lighting and heating for domestic purposes, and the object of his paper was to show how this was possible. Electricity was a form of energy, and this energy in overcoming a resistance became converted into heat and light. If the external circuit of the electric generator was considerable compared with the resistance of the generator itself a corresponding large amount of the energy expended in driving the machine became utilised in the form of heat. This being the case, it could be shown that an indefinitely large number of electric lamps could be worked from central stations with a proportional cost of working.

In general principle his system was similar to that of gas lighting, viz., large mains extended from the

generators and smaller ones branched off from them to the lamps.

The lamps employed by him were on the incandescent principle, and possessed several peculiarities in their construction. The wires leading into the glass bulbs were rendered air-tight by passing through mercury chambers, the latter metal being kept in its place by a stopping of marine glue. The cost of the lamps was stated to be one shilling (for full description of lamp, see TELEGRAPHIC JOURNAL, March 15th). Mr. FOX said that there was nothing in the construction of the lamp that prevented its being indestructible. As regards illuminating power, this he estimated at 150 candles per horse-power if the temperature was not excessive. It was possible, however, to obtain 500 candles per horse-power, but the lamps could not be guaranteed to last at the high temperature necessary to give this light. Taking the consumption of coal in an engine at 1¼ lbs. per horse-power, per hour, this would represent a cost of $\frac{1}{10}$d. per horse-power, per hour.

In the discussion which followed the reading of the paper

Mr. R. E. CROMPTON said that the estimated expenditure of coal per horse-power as given by Mr. Fox was much lower than would as a rule be the case, but even taking a greater cost, still the expense, at least for arc lighting, was less than that for gas. Mr. Fox's method of regulating the speed of the dynamo machine by making the current control the throttle-valve, was one which no engineer would use, as the action would be highly irregular; the proper method to adopt would be to regulate the slide-valve gear, and this could only be done by a considerable expenditure of force, which the current could not give.

Professor AYRTON then explained the construction of his "Portable absolute galvanometer for strong currents." The new instrument, it was pointed out, was free from the defects which existed in those hitherto constructed. The instrument was of small dimensions and was dead beat in its action, the needle moving at once to its correct position.

Professor AYRTON then explained the action of "A new transmission dynamometer," invented by Professor Perry and himself.

In the discussion which followed the explanation

Mr. R. E. CROMPTON stated that an instrument similar to that described, but of better construction, had been used by him some years ago.

The discussion was then adjourned.

City Notes.

Old Broad Street, April 26, 1881.

THE INDO-EUROPEAN TELEGRAPH COMPANY (LIMITED).—The directors' report for 1880 states that the Company's revenue from all sources for 1880 amounted to £98,731 14s. 11d., showing an increase of £12,372 15s. The expenses were £46,463 8s., showing an increase of £672 16s. 7d. After charging £10,169 6s. 5d. percentage upon profits payable to Messrs. Siemens under their maintenance contract, taking credit for the balance brought over from last year, £748 18s. 1d., and deducting income-tax, there remains the sum of £42,362 7s. 1d. From this amount the interim dividend of £10,625 already paid has to be deducted, leaving a net balance of £31,737 7s. 1d. to be dealt with. The directors propose to declare a dividend for the last six months of 17s. 6d. per share, making, with the interim dividend already paid, 6 per cent. for the year, and a bonus of 10s. per share; both free of income-tax. Out of the balance of £8,362 7s. 1d., £7,500 is proposed to be added to the reserve fund, and £862 7s. 1d. to be carried to the credit of the current year. The Company is still pressing its claim against the Russian Government. For the benefit and encouragement of the officers and servants of the Company the directors will submit to the shareholders a proposal to enable them to introduce a system of assurance, endowment, or pension, not to entail in the aggregate a charge exceeding £1,000 per annum. This system has been adopted by all the leading telegraph companies. The Board have appointed Mr. Andrews managing director of the Company's affairs. The meeting will be held at the New Exchange Buildings, George Yard, Lombard Street, on the 28th April at 12 o'clock.

REUTER'S TELEGRAM COMPANY (LIMITED).—The report of this Company to be presented at the seventeenth ordinary general meeting of the shareholders, to be held at the Company's offices, 24, Old Jewry, London, states that the net profits for the year ending the 31st December last, after payment of current charges and deducting bad debts and rebate on unexpired subscriptions, amount to £8,278 16s. 8d., including £108 14s. 9d. brought forward from the last account. The usual interim dividend of 2½ per cent. was paid in October last, and the directors now declare a further dividend of 12s. per share, equal to 7½ per cent., free of income-tax, making a total distribution of 10 per cent. for the year. This will absorb £7,366 6s., and after adding £800 to the reserve fund there will remain a balance of £112 10s. 8d. to be carried forward. The directors have decided to recommend to the shareholders the establishment of an Insurance and Superannuation Fund for the officers of the Company, and a resolution will be submitted to the meeting authorising the directors, out of the receipts of the Company, to apply from time to time a sum not exceeding £300 a year for carrying out that object.

GERMAN UNION TELEGRAPH AND TRUST COMPANY (LIMITED).—The tenth ordinary general meeting of the shareholders in this Company was held on April 12th, at the Offices, Old Broad Street, under the presidency of Mr. H. Weaver. The chairman in moving the adoption of the report (published in our last issue), congratulated them on the highly satisfactory condition of the Company's affairs. The increase in the traffic had been very marked, and he had no doubt that the adoption of the word-rate tariff would cause a still larger increase. Their reserve fund stood at £15,615, and with the renewal fund amounted to £24,268, or about one-seventh of the capital. There was no reason to suppose that they would ever require to renew the cable from end to end, for it was in very shallow water, and in the event of a breakage could be easily raised and mended. Mr. H. G. Erichsen seconded the motion, and it was carried unanimously; and the retiring director and auditor having been re-elected, the meeting closed with a vote of thanks to the chairman and directors.

CONSOLIDATED TELEPHONE CONSTRUCTION AND MAINTENANCE COMPANY.—The applications for shares were, we understand, very large.

THE WEST COAST OF AMERICA TELEGRAPH COMPANY (LIMITED).—We are informed that telegraphic communication is now re-established with all the stations of this Company, between Valparaiso and Lima (Serena, Caldera, Antofagasta, Iquique, Arica,

Mollendo, Callao), and that messages will now be received at the various telegraph offices for transmission to any part of the west coast of South America.

COMPAGNIE FRANÇAISE DU TÉLÉGRAPHE DE PARIS À NEW YORK.—This Company's Brest-St. Pierre cable having been repaired, communication with America, &c., is re-established.

GREAT NORTHERN TELEGRAPH COMPANY OF COPENHAGEN.—At the annual general meeting held at Copenhagen, on the 12th April, 1881, F. Zahle, Esq., presiding, the chairman, C. F. Tietgen, Esq., after having in his introductory remarks referred to some points in the Company's history, and congratulated the shareholders upon the present prosperous state of the Company, reported as follows upon the Company's business generally:—Several of the European cables had suffered from interruptions, and, unfortunately, these had in some cases been of longer duration than ordinarily, owing mainly to stormy weather, which had prevented more speedy repairs. There had been a marked increase in both the extra-European and the European traffic. The increase in the latter was mainly owing to the introduction of the word-rate system adopted by the International Telegraph Conference held in London in 1879, and which took effect on the 1st April, 1880. As compared with 1879, the traffic returns for 1880 showed an increase of £28,000; on the other hand the expenditure had slightly increased. Also with regard to the laying of the new English-Norwegian-Swedish Cable, the shareholders could be congratulated. The cable had been laid from a point near Newcastle-upon-Tyne to Arendal in Norway, and from there to Marstrand, near Gothenburg in Sweden. The total length was about 522 nautical miles. It had been manufactured by the Telegraph Construction and Maintenance Company, Limited, and successfully laid by the same Company in September last. The Swedish and Norwegian Governments had agreed to extend the terms of all the existing concessions until the 1st January, 1911, and if it were considered that out of the Company's nine European cables six were landed in those countries, the prolongation of the Company's monopolies was of an importance which could not be overrated. In accordance with the resolution passed at the extraordinary general meeting of the 17th November last, the capital required for the new cable had been obtained by the issue of £100,000 5 per cent. obligations, redeemable within 20 years. These had been offered to the public by Messrs. C. J. Hambro & Son, in London, and the Private Bank in Copenhagen, and had readily been taken up at par. In consequence of this measure the reserve fund had remained intact; £64,113 17s. 10d. had been further invested on account of that fund, and the interest on the investments would now suffice to meet the interest payable on the new loan. The greatest event of the year for the Company had, however, been its connection with the extension of the telegraph system in China. At the request of the Chinese Government, the Company had, in July last, commenced a survey of the country between Shanghai and Tientsin with a view to the establishment of an overland telegraph service between those two places. On the completion of the survey a plan had been prepared by the Company for the construction of the line, and on the basis of this plan, which was approved by the Government, a contract had been entered into at Tientsin on the 22nd December last, between the Government and the Company. According to this contract the Company would have to supply all materials, instruments, &c., required for the construction of the line and stations, and the Company had also agreed to appoint engineers to superintend the work, which would be commenced on the 15th May this year. The route of the line, which would be of a length of about 1,000 miles, would follow the Grand Canal, and great facilities would thus be offered for the transport of the materials and the subsequent maintenance of the line. Besides this the Company had undertaken to appoint the necessary teachers for a College of Telegraphy which the Government had established at Tientsin. This line from Shanghai to Tientsin would be of the greatest importance for the development of telegraph undertakings in China, as the line would, no doubt, shortly be extended from Tientsin to Pekin, a distance of 80 miles, and thus connect this great capital and Tientsin, the commercial centre of North China, with the lines of the Company, and so with the whole world. As another event of the year, the directors would draw the attention of the shareholders to a contract entered into between the Imperial Russian Government and the Company for supplying and laying a cable of about 70 nautical miles from the eastern coast of Siberia to the Island of Saghalien. The cable had already been manufactured in London, and would be sent out by the Company's s.s. *Store Nordiske*, in order to be laid by that ship during the most favourable season of the year. Without discussion, the report was then unanimously adopted, the accounts were passed, and discharge given to the board of directors. The retiring director, Col. O. V. Hoskiær, R.D.E., was re-elected. The shareholders' auditors, His Excellency Admiral Bille, and A. Berner, Esq., were also re-elected.

The following are the final quotations of telegraphs:—Anglo-American, Limited, 58-58½; Ditto, Preferred, 87-88; Ditto, Deferred, 30½-31; Black Sea, Limited, ——; Brazilian Submarine, Limited, 10¼-10½; Cuba, Limited, 9-9¼; Cuba, Limited, 10 per cent. Preference, 16½-17; Direct Spanish, Limited, 3¼-4¼; Direct Spanish, 10 per cent. Preference, 13-14; Direct United States Cable, Limited, 1877, 11⅜-11½; 6 per cent. Debentures, 100-103; Eastern, Limited, 9¾-10; Eastern 6 per cent. Preference, 12⅞-13; Eastern, 6 per cent. Debentures, repayable October, 1883, 101-105; Eastern 5 per cent. Debentures, repayable August, 1887, 102-104; Eastern, 5 per cent., repayable Aug., 1899, 103-106; Eastern Extension, Australasian and China, Limited, 10⅞-11⅛; Eastern Extension, 6 per cent. Debenture, repayable February, 1891, 109-112; 5 per cent. Australian Gov. Subsidy Deb. Scrip, 1900, 105-107; Ditto, registered, repayable 1900, 105-107; Ditto, 5 per cent. Debenture, 1890, 103-106; Eastern and South African, Limited, 5 per cent. Mortgage Debentures, redeemable 1900, 102-104; Ditto, ditto, to bearer, 102-104; German Union Telegraph and Trust, 11¼-11⅝; Globe Telegraph and Trust, Limited, 6⅞-6⅞; Globe, 6 per cent. Preference, 12⅛-12⅜; Great Northern, 12¾-13; 5 per cent. Debentures, 103-106; Indo-European, Limited, 28½-29½; London Platino-Brazilian, Limited, 6⅛-6⅜; Mediterranean Extension, Limited, 2¼-2⅜; Mediterranean Extension, 8 per cent. Preference, 9¾-10¼; Reuter's Limited, 11-12; Submarine, 270-290; Submarine Scrip, 2⅛-2⅜; Submarine Cables Trust, 99-102; United Telephone Company, ——; West Coast of America, Limited, 4¾-5¼; West India and Panama, Limited, 2-2½; Ditto, 6 per cent. First Preference, 7-7½; Ditto, ditto, Second Preference, 6¼-6⅝; Western and Brazilian, Limited, 8⅜-8½; Ditto, 6 per cent. Debentures "A," 104-108; Ditto, ditto, ditto, "B," 98-102; Western Union of U. S. 7 per cent., 1 Mortgage (Building) Bonds, 124-129; Ditto, 6 per cent. Sterling Bonds, 104-108; Telegraph Construction and Maintenance, Limited, 31-31½; Ditto, 6 per cent. Bonds, 107-110; Ditto, Second Bonus Trust Certificates, 4-4¼; India Rubber Company, 19-19½; Ditto, 6 per cent. Debenture, 104-108.